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# Mariners Weather Log



National Oceanic and Atmospheric Administration • Environmental Data and Information Service





## Mariners Weather Log

Editor: Elwyn E. Wilson  
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July 1979  
Volume 23 Number 4  
Washington, D.C.

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Cover: Except for the Harbour Bridge one might think this was San Francisco. The fog below obscures the beautiful harbor of Sydney, Australia. It delayed both marine and ground traffic.  
Wide World Photo.

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical approved by the Director of the Office of Management and Budget through June 30, 1980.

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# Mariners Weather Log

## SEVERE TROPICAL STORM AGNES, JULY 1978

Gordon Bell  
Royal Observatory  
Hong Kong

In the *Mariners Weather Log* of January 1979 there were two items concerning the AMERICAN APOLLO. In the Smooth Log it is reported that the AMERICAN APOLLO ran into 60-kn winds in 25-ft seas in severe tropical storm Agnes. It is stated of Agnes that "Although she was considered a tropical storm, it is more likely that she reached typhoon strength." I can offer some more information and observations on this interesting storm.

The remarkable track of Agnes (fig. 1) led to it being the only tropical cyclone on record to cause

gale signals to be hoisted twice at Hong Kong. Gales were first experienced there when the storm approached from the southeast and passed close to the south of the territory on a westward course towards the Luichow (Leizhou) peninsula. Severe tropical storm Agnes then began to come under the influence of typhoon Wendy, which was centered off Shanghai. The two storms began to move around and towards one another in accordance with the well-known Fujiwara effect. However, Wendy and Agnes were separated by 1,000 mi, and it is unusual for the effect to be noticeable at

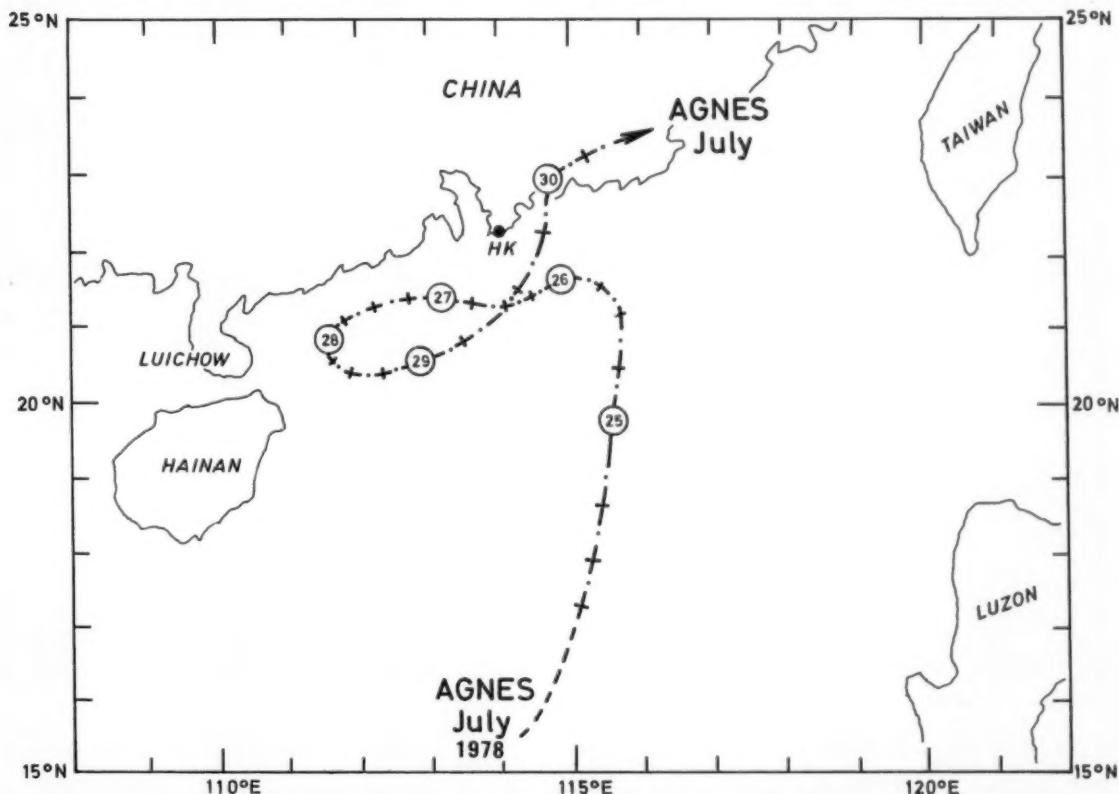


Figure 1. --The track of severe tropical storm Agnes from its formation on July 24, 1978, to its passage across the coast on July 30.

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such a large distance. Agnes turned back, passing southeast of Hong Kong causing gales there once again.

The upper troposphere over Agnes was abnormally warm and limited the depth of convection in the storm. As a consequence, the rainfall rate was never very intense and was less than 10 mm/h for most of the time. Nevertheless, because the storm passed Hong Kong twice, it rained there for over 8 days (July 24-31). In all a total of 514.7 mm of rain was recorded at the Royal Observatory, making Agnes the fourth wettest tropical cyclone since 1884.

The question of the intensity of Agnes was one which greatly concerned forecasters at the time. The storm was particularly well covered by most modern methods

of observation, but there was no aerial reconnaissance. Agnes was under continuous radar surveillance for 6 days, and throughout its life it was observed by the Japanese Geostationary Meteorological Satellite (GMS). In addition, excellent observations were received from island stations and ships. Some relevant observations are included in tables 1 and 2. All these observations indicate that Agnes was a better organized storm on its first approach to Hong Kong during July 26 and 27 than on its second passage during July 29 and 30, although the lowest central pressure of 973 mb was attained on the second passage.

From the radar photographs (fig. 2) the radius of maximum winds expected would be about 20 to 25 mi,

Table 1.--Reports from ships

Ship name	Date/time (GMT)	Windspeed (kn)	Pressure (mb)	Distance/bearing from center (mi/ 16-pt compass) and remarks
STRAAT NAGOYA	250600	47	990.6	55/ESE
MERRY VIKING	252100	50	993.0	70/NNE
S.A. HUGUENOT	260000	45	989.8	55/W
AMERICAN APOLLO	260600	60	985.8	40/E
TOKYO MARU	290900	12	973.0	In the eye
TOKYO MARU	291000	42	981.0	20/S, close to the eye wall

Table 2.--Reports from land stations

Station name	Date	Anemometer ht above MSL (m)	Maximum windspeed recorded (kn)			Minimum pressure (mb)	Distance/bearing from center (mi/ 16-pt compass) and remarks
			Hourly mean	10-min mean	Gust		
First approach							
Waglan Island	July 26	74.7	60	62	76	983.8	55/NNE
Cheung Chau Island	July 26	92.1	48	50	73	988.0	55/NNW
Green Island	July 26	89.8	60	66	90	--	60/N
Tate's Cairn	July 26	588.1	59	64	93	997.0	65/N High-level station
St. John's Island (Shangchuan Dao)	July 27	18.0	--	52	76	984.8	30/S
Second approach							
Waglan Island	July 30	74.7	46	48	61	980.0	30/WSW
Cheung Chau Island	July 30	92.1	36	37	52	988.1	40/W
Green Island	July 30	89.8	40	45	58	--	35/W
Tate's Cairn	July 30	588.1	48	49	70	996.5	35/W High-level station



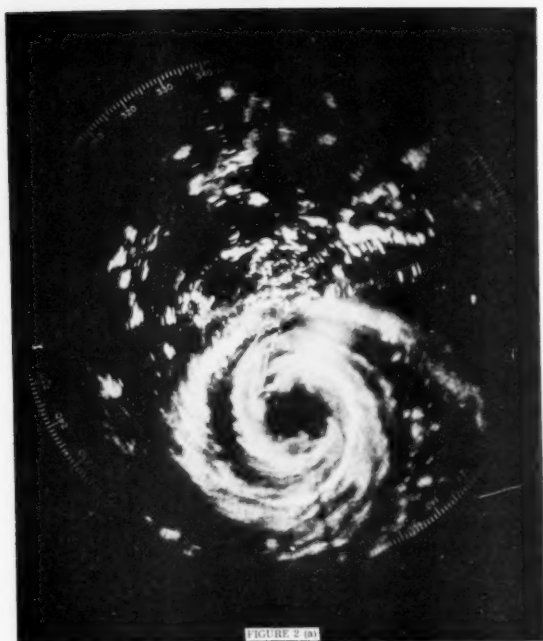


FIGURE 2 (a)



FIGURE 2 (b)



FIGURE 2 (c)

Figure 2.--Photographs of the Royal Observatory radar display of severe tropical storm Agnes on the 120-mi range with range rings of 40-mi intervals at (a) 0600 July 26 when the AMERICAN APOLLO was 40 mi east of the center under a heavy rain band; (b) 0000 July 27 when the eye was best developed with a 26-mi diameter; and (c) 0900 July 29 when the eye was small and filling with rain clouds and the TOKYO MARU reported the pressure in the eye as 973 mb.

and indeed the fastest echo observed in the radar time-lapse film was 66 kn at 22 mi from the center on July 26. The AMERICAN APOLLO reported 60-kn winds and 985.8 mb pressure when in a spiral rainband 40 mi east of the center at 0600 on the 26th. On July 29 the center of Agnes passed over the TOKYO MARU, which recorded a minimum central pressure of 973 mb and maximum winds of 42 kn in the eye wall. Dvorak's method of estimating the intensity of tropical cyclones from satellite pictures (fig. 3) indicated that between 1142 on the 25th and 0842 on the 26th the central pressure was about 981 mb with maximum 1-min mean winds of 65 kn. This wind is equivalent to a sustained (10 min) wind of 57 kn.

All observations indicate that severe tropical storm Agnes attained a central pressure of about 970 mb with maximum sustained 10-min windspeeds close to 60 kn and gusts to about 80 kn. From these observations the storm did not quite meet the criteria in the international definition for a typhoon. In marginal cases of this kind, differences in the terminology used to describe tropical cyclones by different meteorological services in different regions become relevant.

The international definition [World Meteorological Organization (WMO) Congress 1959] of a typhoon, or local synonym, is a tropical cyclone in which surface winds of Beaufort Force 12 are observed. Using the equivalents currently accepted by WMO, Force 12 translates as an hourly mean windspeed of 64 kn or more at a height of 10 m. Because of the speed of

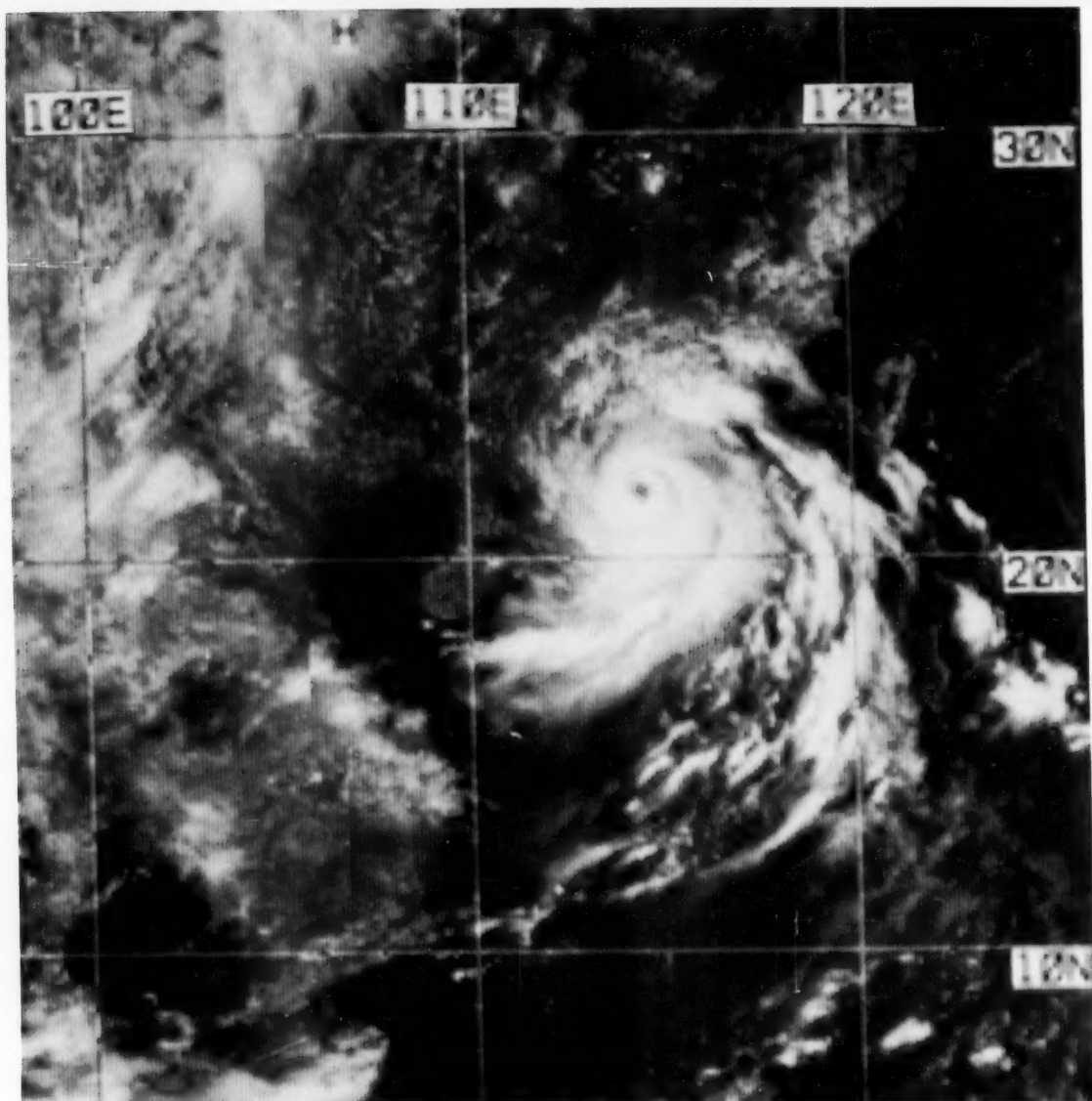


Figure 3.--Agnes shows a well-defined eye in this satellite picture as she approaches Hong Kong on her first pass at 1859 July 26, 1978. (DMSP Imagery)

movement of tropical cyclones and the small proportion of the storm area containing high speed winds, an hourly mean wind is not always a suitable measure of intensity. The definition then rests on a "sustained wind" of 64 kn or more, and for this purpose it is usual to use the international standard 10-min averaging period. Such a sustained wind would be associated with gusts approximately 40 percent greater. United States authorities use a 1-min average windspeed of 64 kn as the lower criterion for a typhoon or hurricane.

On this basis the associated sustained winds (10 min) would be about 56 kn. Severe tropical storm Agnes with sustained winds of 60 kn and gusts to about 80 kn therefore would be a typhoon by the U.S. definition and a severe tropical storm by the international criteria used by meteorological services in the western North Pacific. Incidentally, in the United States, the international grading of "severe tropical storm (48 to 63 kn)" is not used. Storms of this intensity are grouped with tropical storms to cover windspeeds (1-min means) from 34 to 63 kn.

## GREAT LAKES NAVIGATION SEASON, 1978

Elwyn E. Wilson  
Environmental Data and Information Service, NOAA  
Washington, D.C.

There was continuous operation again this calendar year on the Lakes west of Buffalo, but by the last of February the traffic had dwindled to a trickle. The main traffic that continued through the winter was ore boats. The annual article describing the 1977-78 winter ice season can be found in our November 1978 issue. The temperatures averaged 4.1°F below normal for the Great Lakes during January through April. February was the coldest month with an average overall of 7.5°F below normal, and Lake Erie was the coldest of the five lakes with 11.6°F below normal. The northern lakes did not completely freeze over but reached 80 to 90 percent coverage. The Welland Canal and the St. Lawrence Seaway opened on schedule.

The French vessel HERMINE (fig. 4) was the first upbound ship in the Montreal-Lake Ontario section of the St. Lawrence Seaway. The J.N. MCWATTERS was the first downbound ship. The TARANTAU was the first vessel to pass through the Welland Canal, where she had wintered. The Canadian Soo Lock opened on

April 17.

The St. Lawrence Seaway remained open until December 22, 1978, with the J.N. MCWATTERS the last laker downbound and the SILVER ISLE the last laker upbound. The HAND FORTUNE was the last saltie downbound and almost had to spend the winter in the Lakes because of violating the cutoff date on her upbound voyage. The JOANA was the final ship leaving the Seaway, but she had offloaded below the U.S. locks (fig. 5).

The Welland Canal closed on December 30, 1978, with the NIPICON BAY and the HOCHELAGE the last lakers to transit the canal down and upbound, respectively.

Among the ships launched this year were the 300-ft heavy-lift vessel JOHN HENRY and the 1,000-ft laker EDWIN H. GOTT (fig. 6).

The center lakes--Michigan, Huron, St. Clair, and Erie--were above their 1900-77 average water level all year. The two end lakes--Superior and Ontario--

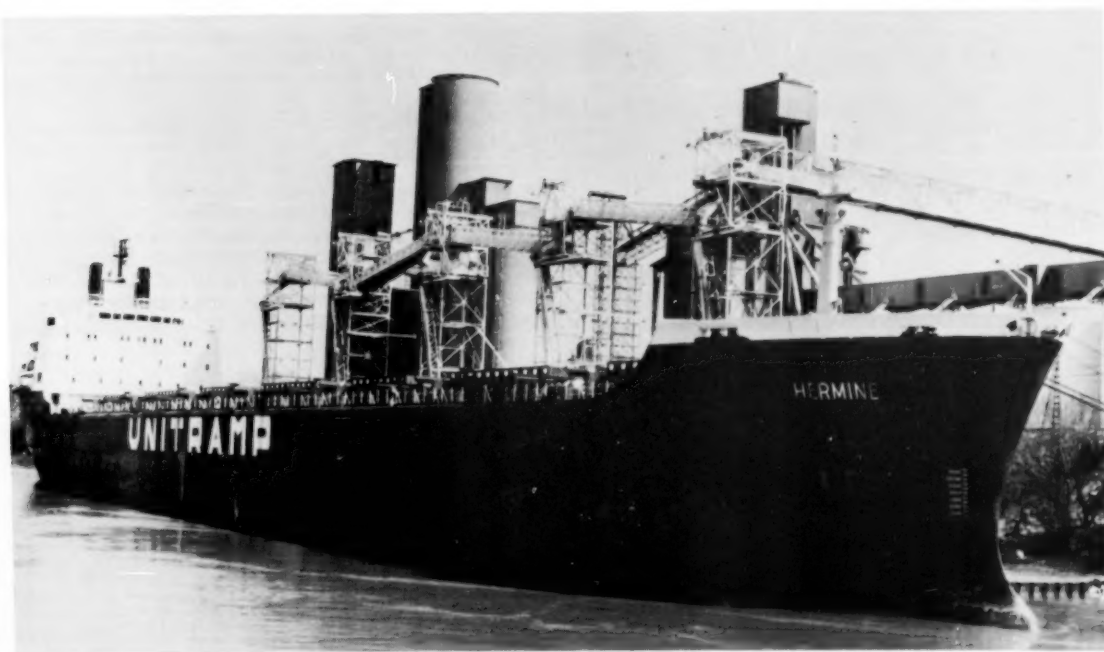


Figure 4.--The HERMINE, shown here at Toledo, was the first 1978 upbound ship on the St. Lawrence Seaway.  
Photo by Albert G. Ballert.



Figure 5.--The MARE SERENO made three lake trips in 1978 and was the last "salties" to depart from the Upper Lakes area, leaving Duluth on December 11. Photo by Albert G. Ballert.



Figure 6.--The new lake carrier EDWIN H. GOTT being floated from drydock July 19 at Bay Shipbuilding. Photo by Albert G. Ballert.

started the year above their long-term average, but dropped below the average later in the year. At their peak level all the lakes, except Superior, were higher this year than in 1977.

Precipitation over the Great Lakes Basin was slightly above the long-term annual average. Lakes Erie and Ontario were slightly below the average. The yearly average (table 3) does not reveal the substantial difference in precipitation between the first and second half of the year. For the January-June period precipitation was 11 percent below normal for the basin. This deficit was recovered during the last 6 mo with Lakes Michigan 22 percent and Superior 18 percent above normal. The winter of 1977-78 ended with record snowfalls in many places.

#### NATIONAL WEATHER SERVICE AIDS

The National Weather Service (NWS) provided routine weather services for the 1978 navigation season. Forecasts were prepared for the entire year for the Great Lakes west of Buffalo and during the regular

Table 3.--Annual precipitation data (in) for 1972-78

	Great Lakes	Lake Ontario	Lake Erie	Lake Huron	Lake Michigan	Lake Superior
1972	35.97	43.67	39.70	35.32	34.97	32.22
1973	33.87	38.16	37.01	33.34	33.98	30.84
1974	28.94	33.42	34.14	25.92	32.77	23.86
1975	34.62	38.53	38.95	34.58	35.74	29.81
1976	31.06	40.92	35.88	33.43	26.54	25.97
1977	38.84	44.26	42.79	37.04	34.42	39.93
1978	32.25	34.08	32.38	31.39	33.67	30.99
1900-78 average	31.69	34.57	33.98	31.43	31.35	29.73
1978 average (percent)	+2.0	-1.0	-5.0	0.0	+7.0	+4.0



navigation season (April through December) for Lake Ontario and the St. Lawrence River system. Fifteen offices provided near-shore forecast services during the small boating season in their respective service areas.

Radio dissemination by voice of routine and emergency weather information was made from NWS Weather Radio Stations in 16 cities around the Lakes. Two stations in Michigan, Alpena and Marquette, expanded their hours to provide service 24 hr per day. Voice broadcasts were also made through the Lorain Electronics Communication gateways and through the Central Radio Stations on northern Lakes Michigan and Huron.

Radiofacsimile services continued through the winter ice season from Lorain, Ohio, and weather maps were transmitted through early summer. Equipment failures during the summer months caused a suspension in broadcasts, but they were resumed in the fall.

The number of warnings for the year (table 4) was slightly down from 1977. January was more stormy than usual with storm warnings in effect on four occasions in Lakes Michigan and Superior and on three occasions on Lake Erie. Lake Michigan had the most gale warnings for the year with 12 of them in November and 13 in December. Eight gales were reported on Lakes Superior and Huron and four on Lake Erie in November. December was a windy month with the most gale reports for the season--43. Lake Michigan had 13, Lake Erie had 12, and Lakes Superior and Huron each had 9 reports of gales.

Table 4.--1978 Great Lakes warnings summary

	Gale	Storm
Lake Superior	53	5
Lake Michigan	60	7
Lake Huron	48	4
Lake St. Clair	15	1
Lake Erie	36	5
Lake Ontario	6	1
St. Lawrence River	1	0
Total	219	23

#### ICE SEASON

The winter of 1977-78 was another very cold one across the Great Lakes. Ice formed early. As the new calendar year dawned, ice covered the Lake Erie region west of the islands and in portions of the remainder of the lake. Ice was also reported in the Straits of Mackinac. Foot-thick ice covered Green Bay and 6-in thick ice was observed in the St. Marys River. Very cold weather dominated the middle 2 weeks of January and snow fell frequently. Ice conditions worsened to "severe" on Lake Erie, and regular assistance was necessary on the St. Marys River.

The worst storm of the winter struck the Lakes region--especially the Lower Lakes on January 26. The white hurricane with 80- to 90-kn winds hit about dawn. Record low pressures were reported in Cleveland (28.28 in) and at both Detroit and Erie (28.34 in). By the end of the month ice had expanded out from the shorelines of Lakes Michigan and Superior and northern Lake Huron. The southern end of Lake Huron

was covered with 10 in of ice. Whitefish Bay and the St. Marys River were solid. Up to 12 ft of windrowed ice was observed in western Lake Erie and 2 to 6 ft off Cleveland. Traffic on the St. Marys River was slowed by shore ice up to 15 ft thick.

February was the frigid month of the winter season. Temperatures were consistently cold throughout the month and were comparable to January of the previous year. Because of the severe cold, ice cover continued to expand and became more stable. Temperature records fell several times during the month. Slightly milder air reached the Lower Lakes during the last week of February, pushing readings above freezing for the first time in over a month at Cleveland and Detroit. The most dramatic changes in ice cover were observed on Lake Huron with 90-percent cover by monthend and on Lake Superior with 85-percent cover.

Cold weather continued into March. Temperatures averaged below normal for all the Lakes, but periodic milder spells became more numerous. On March 9 the mercury edged up to 33°F at Alpena, Mich., which was the first time it was above freezing in 59 days.

During the first week of March ice expanded on Lake Superior to cover most of the open water in the eastern sections. Drift ice in Lake Michigan spread over all of the lake's northern half. Milder weather at midmonth began to change conditions. On Lake Huron a large lead from Alpena to Tawas expanded, and about a third of the lake was open by the 15th. By the end of the month only drift ice remained south of the thumb and the eastern third of the lake to the approaches to Georgian Bay. On Lake Superior by midmonth solid ice cover decreased to pack ice, except through the Apostle Islands. The only ice remaining by monthend was in bays and harbors along southern and eastern shores. On Lake Michigan ice remained in the Straits and Green Bay. On Lake Erie ice deteriorated from Cleveland westward to the Islands and loosened from the Islands to within 50 mi of Buffalo by March 31. Lake St. Clair was 70 percent covered.

The St. Lawrence Seaway officially opened on schedule in early April. The Welland Canal opened on March 30. Ice in almost all areas of the Lakes gradually disappeared during April in spite of below-normal temperatures. Ice gradually disappeared in the remaining waterways in May. As usual, the last ice to go was in the Buffalo area. Operation "Open Buffalo" was terminated on May 15.

Normal to slightly above-normal temperatures prevailed across the Lakes region from September through November. Because of the severity of the previous winter and nearly normal temperatures during the summer, heat content of the northern lakes was below normal going into the fall season. Fall outbreaks of Canadian air cooled shallow water areas rather rapidly in November. Ice was first observed at Duluth before the end of November.

In the southern lakes, a warm spring and summer had left water temperatures well above normal by mid-November. A later-than-normal freezeup was forecast for these areas.

Late November was stormy and cold over the Lakes. Green Bay received 4 in of snow on Thanksgiving. Bone-chilling cold settled into the Upper Lakes during the last few days of November and early December. The first of a series of December storms hit Chicago and Wisconsin during the first few days of the

month. Chicago had 6 in of snow. Cleveland also had 1 ft of snow before December 10.

By mid-December some drift ice had formed in extreme western Lake Erie, portions of Lake St. Clair, and eastern Saginaw Bay. Ice continued to expand away from shore in the St. Marys River, Green Bay, and the shallows of Lake Superior. By Christmas the lower St. Marys River had frozen over. Ice was observed over all of Green Bay, although it remained adrift. At the eastern end of the Lake system, the St. Lawrence Seaway closed on schedule on December 20. Only minor ice problems and a few weather delays marked the last few days of the season. The Welland Canal closed on December 30.

By New Year's Eve ice covered most of Green Bay, Saginaw Bay, St. Marys River, Lake Erie west of the islands, and the North Channel area of Lake Huron. Most of the ice was drifting with the wind. New ice also began to form in the Chicago area in the southwest corner of Lake Michigan.

#### GREAT LAKES OBSERVATION PROGRAM

There were 71 ships listed in the Great Lakes weather reporting program this year. This is considerably more than in previous years and is reflected in the number of observations received at the National Climatic Center in Asheville, N.C. --17,671. The number of participating ships was in the low 30's for many years, but it increased to 47 ships last year. Of the 71 vessels in the program, 57 sent reports (fig. 7). The following number of observations by lake were received.

Lake Ontario	11 by 3 ships
Lake Erie	1,568 by 52 ships
Lake Huron	5,343 by 55 ships
Lake Michigan	3,635 by 48 ships
Lake Superior	7,114 by 52 ships

Gales (winds of 34 to 40 kn) were reported the following number of days: Lake Ontario - 0; Lake Erie - 24; Lake Huron - 45; Lake Michigan - 42; and Lake Superior - 65. Strong gales (41 to 47 kn) were reported 7 days on Lake Erie, 11 days on Lake Huron, 12 days on Lake Michigan, and 18 days on Lake Superior. Storm winds (48 to 55 kn) were observed on 2 days on Lake Erie, 3 days on Lake Michigan, and 1 day on Lake Superior. Violent storm winds (56 to 63 kn) occurred 1 day on Lake Superior in November, and on Lake Erie 70- to 80-kn winds were measured on January 26.

The most observations were made in October, followed by September, June, July, and November--all with over 2,000 observations per month. Table 5 shows high-wind observations by 10-kn categories.

Table 5.--Number of high-wind observations during calendar year 1978

Category	Observations
Over 30 kn	703
Over 40 kn	71
Over 50 kn	6
Over 60 kn	2
Over 70 kn	1

There were 31 observations of waves over 12 ft including two of 19.5 ft. January had the most days and observations with waves over 12 ft.

Tables 6 through 13 summarize the maximum winds and waves. The tables include only those observations that were logged on Great Lakes Observation Form 72-2 and forwarded to the National Climatic Center.

#### NOTABLE WEATHER HAPPENINGS

November led with the most observations with high



Figure 7.--Two new lake carriers, the GEORGE A. STIMSON (left) and the LEWIS WILSON FOY (right), meet in the Detroit River in front of the Renaissance Center. Photo by Albert G. Ballert.



Table 6. --Maximum windspeed reported on Lake Ontario for each month by National Weather Service cooperating vessels, 1978

Month	Kn	Direction	Time (GMT)	Date	Ship	Lat. (°N)	Long. (°W)
January							
February							
March							
April	19	290°	0600	08	NORTHWIND	43.5	77.7
May							
June							
July							
August							
September							
October	16	180°	0600	19	BENJAMIN F. FAIRLESS	43.7	77.2
November	33	290°	0000	15	BENJAMIN F. FAIRLESS	43.7	77.6
December							
Year	33	290°	0000	Nov. 15	BENJAMIN F. FAIRLESS	43.7	77.6

Table 7. --Maximum windspeed reported on Lake Erie for each month by National Weather Service cooperating vessels, 1978

Month	Kn	Direction	Time (GMT)	Date	Ship	Lat. (°N)	Long. (°W)
January	80	210°	1200	26	J. BURTON AYERS	41.8	82.6
February							
March	35	060°	0300	25	NORTHWIND	41.9	81.6
April	28	220°	0000	13	JOHN G. MUNSON	41.9	82.1
	28	040°	1200	26	LEON FALK, JR.	41.8	82.5
May	35	070°	0000	05	CHARLES M. WHITE	41.9	80.7
June	28	230°	0000	10	LEHIGH	42.8	79.1
July	26	200°	1200	23	LEHIGH	42.2	81.3
	26	320°	1800	01	CHARLES M. BEEGHLY	41.8	81.5
August	32	290°	1200	17	SAMUEL MATHER	42.4	80.5
September	44	070°	1200	13	HERBERT C. JACKSON	42.4	80.0
October	40	200°	0000	26	HERBERT C. JACKSON	42.2	81.1
November	45	240°	0600	18	J. BURTON AYERS	41.8	83.2
	45	260°	1800	28	PHILIP R. CLARKE	41.9	81.0
December	40	250°	1800	04	J.A.W. IGLEHART	41.7	82.4
Year	80	210°	1200	Jan. 26	J. BURTON AYERS	41.8	82.6

winds. The highest wind of 80 kn was produced January 26 on Lake Erie. The two highest wave reports of 20 ft were during January on Lake Superior and October on Lake Michigan. There were two reports of funnel clouds during July by the MIDDLETOWN, one over Lake Superior on the 25th and the other over Lake Huron on the 27th. There were several special observations and synoptic observations with remarks. An interesting one indicated the "wind indicator frozen." The largest amount of ice accretion was 3.5 in by the WILLIS B. BOYER. The BENJAMIN FAIRLESS and ENDERS M. VOORHEES indicated they were stuck in ice during late January.

May took the award for poor visibility with 341 observations under 2 mi. This was 17 percent of the observations. Lake Superior had the highest percentage of low visibility with 8.5 percent.

Data and numbers for the beginning and end of the season must be evaluated in terms of the number of

ships operating. The more severe storms are most likely to occur when fewer ships are operating.

The following paragraphs describe by month some of the more severe storms as indicated by ship observations. February and March are not included because of the sparsity of observations. Figure 8 shows the tracks of the more severe storms. There are some observations over 50 kn noted in the descriptions that were not associated with a specific storm system; therefore, they are not plotted on this figure.

#### JANUARY

This was a very bad month in the Lakes region. The storm on the 26th and 27th was one of the worst storms in history.

The first bad storm of the month developed over the Indiana-Ohio borders early on the 8th southeast of a large cold 1053-mb HIGH over western Canada. The HIGH was blowing very cold air southward over the

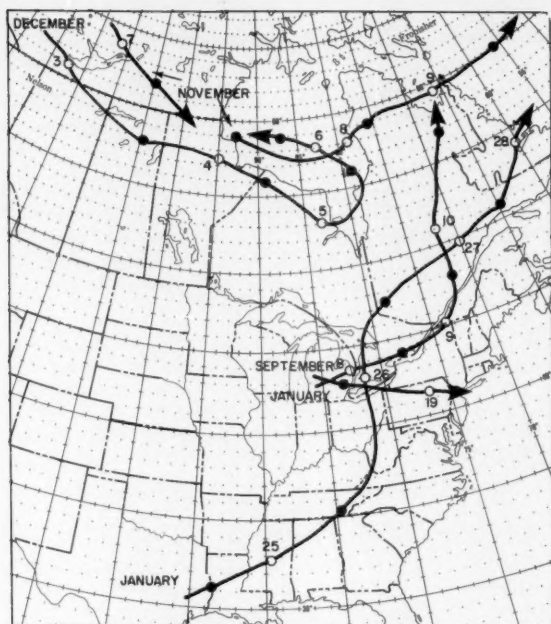


Figure 8.--Tracks of 1978 Great Lakes storms with winds greater than 50 kn. Open circles indicate the position of the center at 1200 of date shown. The closed circle indicates the 0000 position.

Great Lakes. On the 9th the ARTHUR M. ANDERSON was sailing northward on Lake Michigan into north-westerly winds up to 47 kn with a temperature of  $-15^{\circ}\text{C}$ . The NORTHWIND was on Lake Erie and measured 54 kn from  $310^{\circ}$  at 2100. The CASON J. CALLAWAY indicated in the remarks section that her wind indicator was frozen. She was on Lake Superior with  $-25^{\circ}\text{C}$  air.

The low-pressure center was moving northeastward up the St. Lawrence River Valley on the 10th as the HIGH plunged south-southeastward over the Plains States. The ANDERSON and NORTHWIND still had winds over 45 kn. Winds up to 55 mi/h drifted snow over Michigan. Gusts up to 60 mi/h were recorded at the Erie airport.

The CHARLES M. WHITE found the highest waves of the year on Lake Huron on the 11th. They were 18 ft with 40-kn winds. Earlier on the 3d she had 20-ft waves on Lake Superior, which were the highest for the year for that lake. By 1200 on the 11th the HIGH was 1038 mb over southern Illinois and the 958-mb LOW was entering the Davis Strait. The winds were less than 40 kn and were below gale strength by the 12th.

The worst storm of the year began as any other frontal wave over the Texas-Louisiana border on the 25th. By 0000 on the 26th the LOW had deepened to 980 mb. A HIGH north of Lake Winnipeg was feeding arctic air over the Plains States. Another large HIGH over the central North Atlantic was feeding warm air and moisture into the East Coast. A weather observer/forecaster in Massachusetts reported the temperature rose  $18^{\circ}\text{F}$  in just a few minutes on the 26th.



Figure 9.--The arctic icebreaker NORTHWIND was assigned to keep the Great Lakes shipping lanes open during the winter of 1977-78. U.S. Coast Guard Photo.



Figure 10.--The training vessel ALLEGHENY rests on her side in Traverse Bay after tons of ice capsized her. The ice built up from spray blowing on the 900-ton ship and freezing during blizzard conditions. United Press International Photo.

The first 40-kn winds were measured by the J. BURTON AYERS on Lake Erie at 0600 on the 26th. At 1200 she was set in ice off Pelee passage and measured 80-kn winds with gusts to 98 kn. An automated weather station at the Cleveland Crib recorded 89 kn and a bridge near the harbor was blown down. Gusts of 68 kn were measured at the Erie airport. The NORTH-WIND (fig. 9) was north of Lorain going to the assistance of the AYERS with 50-kn winds. At 9 a.m. local time they were 80 kn gusting to 90 kn. The LEON FRASER was on Lake Huron with northerly winds of 45 kn. The ARTHUR M. ANDERSON found 50-kn winds on Lake Superior. The CHARLES M. BEEGHLY was blown aground in the St. Marys River near Sault Ste. Marie. The maritime academy training vessel ALLEGHENY capsized from the weight of ice built up from blowing spray in Traverse Bay (fig. 10).

The LOW passed near Cleveland about 1200 on the 26th (fig. 11) with a record low pressure of 28.28 in (957.7 mb). Other low pressures were Detroit, Mich., and Erie, Pa., with 28.34 in (959.7 mb) and Columbus, Ohio, with 28.47 in (964.1 mb) (fig. 12).

The Great Lakes Basin was paralyzed from snowfalls up to 17 in and drifts up to 16 ft. Snowfall records for a 24-hr period were set in several places. A passenger train was stranded in Indiana in a snow bank. In Ohio it was estimated that 150,000 people were without power and heat. Over 5,700 motorists were rescued from stranded vehicles with another 2,000 that had not been reached. The death count was at least 51.



Figure 11.--GOES 1 satellite catches record-breaking Great Lakes cyclone at 1700 January 26. Note the long trailing cold front which has swept across the country to southern Florida.

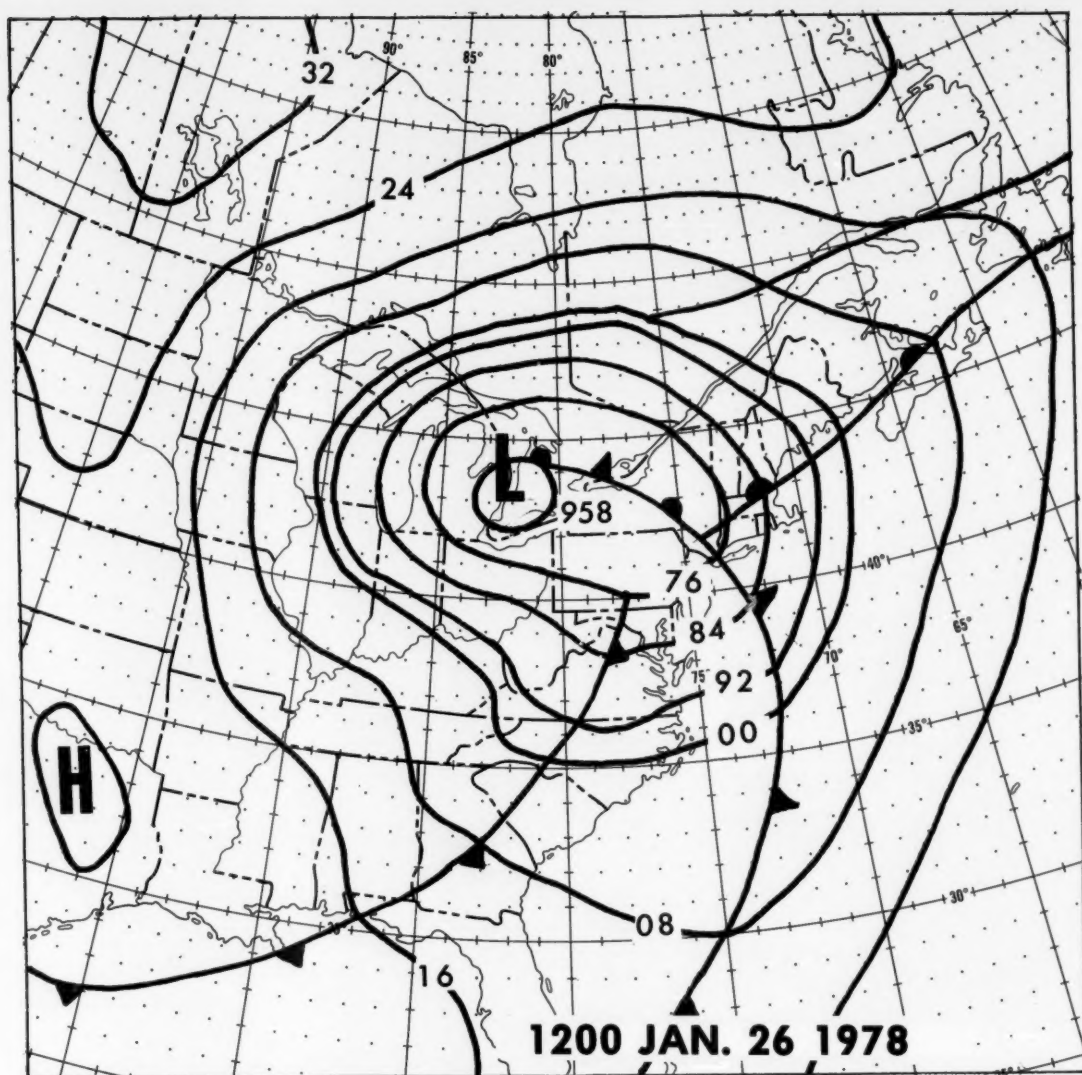


Figure 12.--This record-breaking 958-mb LOW set low-pressure records along the shores of Lake Erie. At the time of this map (1200 January 26, 1978) the J. BURTON AYERS reported an all-time high wind for a cooperative ship on Lake Erie of 80 kn.

At 1200 on the 27th the LOW had two centers, one of 980 mb north of Lake Ontario and the other 981 mb north of Quebec. The NORTHWIND still measured 45-kn winds. The J. BURTON AYERS had 47-kn westerly winds at 0000 on the 28th with  $-27^{\circ}\text{C}$  temperature. The few other ships reporting were generally in the 30-kn range. On the 29th the storm was over the Labrador Sea.

#### APRIL

The month started with a LOW moving eastward along latitude  $50^{\circ}\text{N}$ . There was a second LOW at the point of occlusion over Wisconsin at 0000 on the 1st. By the 1200 map the second LOW had taken over the

circulation over Georgian Bay. There were snow showers and strong winds in the Sault Ste. Marie area. At 0000 on the 2d the IRVING S. OLDS found the highest winds of the month on Lake Huron. The season had just opened and there were not too many ships out. By the 3d the storm was over Newfoundland and there was a HIGH pushing into the area. There were snow, sleet, and freezing rain over the western region.

On the 11th a front moved across the area and a tornado was sighted northwest of Port Huron. It was last sighted over Lake Huron before disappearing.

The LOW that brought the most observations of gale-force winds this month moved across Lake Superior into Ontario on the 13th. The CASON J. CAL-



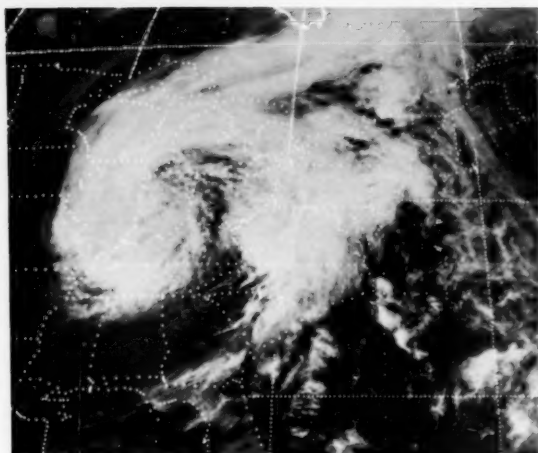


Figure 13.--This satellite picture captures the storm on May 13 as the LOW was raising havoc over Lake Michigan.

LAWAY (Lake Superior), T. W. ROBINSON (Lake Michigan), JOSEPH H. THOMPSON (Lake Superior), and the CHARLES M. WHITE (Lake Michigan) all had winds up to 35 kn. It was only on the early morning observation that the winds reached gale force.

Between the 18th and 20th a storm center moved along the southern edge of the Lakes. The CALLAWAY

started out the reports at 0600 on the 18th on Lake Michigan with 36 kn out of the east. On the 19th the G. M. HUMPHREY measured 32 kn on Lake Huron. The JOSEPH H. THOMPSON closed out the storm with 36-kn winds from the northeast late on the 20th. On the 19th a funnel cloud was sighted over southeastern Michigan that moved over Lake Erie.

On the 29th high pressure was pushing southward over the Lakes from a center north of Hudson Bay. The gradient produced some winds over 30 kn on Lake Superior.

#### MAY

The month began with record cold temperatures at many locations around the Lakes. Heavy fog was reported on the 5th, 8th, and 12th. On the 12th visibility was near zero along the eastern shore of Lake Michigan and the southeastern shore of Lake Superior. At 1800 on the 11th the JOHN DYKSTRA was on Whitefish Bay with 45-kn south-southwesterly winds. She also sent a "Special" observation indicating winds of 50 kn gusting to 55 kn and waves of 8 ft.

On the 12th two weak LOWs were located west of Lake Michigan. By 1200 on the 13th they had combined into one 989-mb LOW over Chicago (fig. 13). At that time the WILFRED SYKES was near Milwaukee with 45-kn winds from the north and heavy rain. Six hours later the GEORGE A. SLOAN was near the center of the lake with 35-kn winds. The LEHIGH was reporting 13-ft waves, the highest for the month (fig. 14). On the 14th at 1200 the LOW was near Columbus, Ohio. Two ships had winds greater than 40 kn. They were the THOMAS



Figure 14.--The PHOTINIA ran into trouble on May 13 on Lake Michigan off the Port of Milwaukee. The vessel dragged anchor in high winds and waves while awaiting a berth. Wide World Photo.

Table 8.--Maximum windspeed reported on Lake Huron for each month by National Weather Service cooperating vessels, 1978

Month	Kn	Direction	Time (GMT)	Date	Ship	Lat. (°N)	Long. (°W)
January	50	060°	0600	14	CHARLES M. BEEGHLY	44.7	81.5
February	24	270°	1800	17	CASON J. CALLAWAY	45.8	84.2
March	36	290°	1200	19	CASON J. CALLAWAY	45.9	84.4
April	40	300°	0000	02	IRVING S. OLDS	45.0	83.1
May	36	290°	1800	01	ERNEST R. BREECH	45.2	83.1
June	34	320°	1200	13	J. BURTON AYERS	44.8	82.9
July	34	360°	0000	30	ROBERT C. STANLEY	44.6	82.7
August	36	200°	1200	19	ERNEST R. BREECH	44.1	82.5
	36	290°	1200	17	WILLIAM CLAY FORD	45.3	83.1
September	45	090°	1800	18	CASON J. CALLAWAY	45.6	83.7
October	38	300°	0000	23	J. L. MAUTHE	45.2	83.2
November	46	220°	0000	30	RALPH H. WATSON	44.4	83.0
December	45	310°	1800	13	THOMAS WILSON	45.6	83.7
Year	50	060°	0600	Jan. 14	CHARLES M. BEEGHLY	44.7	81.5

Table 9.--Maximum windspeed reported on Lake Michigan for each month by National Weather Service cooperating vessels, 1978

Month	Kn	Direction	Time (GMT)	Date	Ship	Lat. (°N)	Long. (°W)
January	47	300°	0000	09	ARTHUR M. ANDERSON	42.6	87.7
February	45	320°	1200	05	ARTHUR M. ANDERSON	45.1	86.9
March	30	230°	1800	09	CASON J. CALLAWAY	45.8	85.9
April	36	090°	0600	18	CASON J. CALLAWAY	42.1	87.2
May	45	350°	0000	14	JOHN G. MUNSON	41.6	87.3
June	37	190°	0000	11	GEORGE A. SLOAN	44.6	86.4
July	32	240°	0000	10	PHILIP R. CLARKE	45.4	85.5
August	45	240°	0400	16	JOHN G. MUNSON	42.2	87.3
September	55	080°	1800	18	HERBERT C. JACKSON	45.8	85.0
October	46	200°	1800	24	MESABI MINER	45.9	85.5
November	48	260°	0000	18	JOHN G. MUNSON	42.7	87.5
December	55	240°	0000	05	CHARLES M. BEEGHLY	45.6	87.0
Year	55	080°	1800	Sept. 18	HERBERT C. JACKSON	45.8	85.0
	55	240°	0000	Dec. 05	CHARLES M. BEEGHLY	45.6	87.0

WILSON with 46 kn on Lake Superior, the highest wind for all the lakes for the month, and the JOHN G. MUNSON on southern Lake Michigan with 45-kn winds. The LOW weakened by the 15th, and no more gales were reported.

For the remainder of the month the Lakes were generally under various levels of high pressure. Weak LOWs and fronts passed over or near the Basin, but produced little bad weather except fog and thunderstorms. On the 20th a tornado twisted a radio tower in Michigan, and gusts above 52 kn were reported at Lorain, Ohio, and the harbor at Cleveland. On the last day of the month a funnel cloud was sighted near Alpena that dissipated over Lake Huron. There were many instances where the visibility was less than the length of the ship, especially during the last week of the month.

#### JUNE

This month was noted more for its cool temperatures

than anything else. There were four mornings when record low temperatures were set at various stations in the Basin. The highest winds of 37 kn were recorded by two ships on 3 days on Lakes Superior and Michigan. On the 2d the G. M. HUMPHREY was on central Lake Superior. A 1007-mb LOW was north of Lake Huron with a cold front south through Michigan. A secondary small 1007-mb LOW was following near Thunder Bay, and it was probably this small cyclone that produced this isolated gale. On the 8th the HUMPHREY was in Whitefish Bay when she registered northerly 37-kn winds with squalls. A frontal wave was moving over Lake Michigan with thunderstorms along the front. On the 11th a LOW was moving north of the Lakes with strong southerly flow south of the warm front. The GEORGE A. SLOAN on northern Lake Michigan also had 37-kn winds. Two other ships on Lake Superior had winds in the low 30's. The front out of this LOW dragged across the Lakes, and on the 12th



Table 10.--Maximum windspeed reported on Lake Superior for each month by National Weather Service cooperating vessels, 1978

Month	Kn	Direction	Time (GMT)	Date	Ship	Lat. (°N)	Long. (°W)
January	50	360°	1200	26	ARTHUR M. ANDERSON	48.3	86.2
February	40	360°	1200	05	CASON J. CALLAWAY	48.3	87.6
March	28	300°	0600	23	CASON J. CALLAWAY	47.3	90.7
	28	060°	1800	31	CASON J. CALLAWAY	47.3	90.8
April	36	030°	0600	20	LEON FRASER	47.6	87.4
	36	050°	1800	20	JOSEPH H. THOMPSON	48.3	86.3
May	46	060°	0600	14	THOMAS WILSON	48.1	86.2
June	37	270°	0600	02	G.M. HUMPHREY	47.5	87.8
	37	020°	0000	08	G.M. HUMPHREY	46.9	85.6
July	33	180°	0000	13	ERNEST R. BREECH	46.7	86.5
August	36	220°	0600	15	ELTON HOYT II	47.4	89.0
September	43	090°	1200	12	A.H. FERBERT	47.7	90.5
October	46	190°	1200	30	CHARLES M. BEEGLY	47.3	87.2
November	56	190°	2200	08	ROBERT C. STANLEY	46.7	85.8
December	45	230°	1800	04	HOMER D. WILLIAMS	47.3	89.9
Year	56	190°	2200	Nov. 08	ROBERT C. STANLEY	46.7	85.8

Table 11.--Maximum windspeed reported for each month for the Great Lakes by National Weather Service cooperating vessels, 1978

Month	Kn	Direction	Time (GMT)	Date	Lake	Ship	Lat. (°N)	Long. (°W)
January	80	210°	1200	26	Erie	J. BURTON AYERS	41.8	82.6
February	45	320°	1200	05	Michigan	ARTHUR M. ANDERSON	45.1	86.9
March	36	290°	1200	19	Huron	CASON J. CALLAWAY	45.9	84.4
April	40	300°	0000	02	Huron	IRVING S. OLDS	45.0	83.1
May	46	060°	0600	14	Superior	THOMAS WILSON	48.1	86.2
June	37	190°	0000	11	Michigan	GEORGE A. SLOAN	44.6	86.4
	37	020°	0000	08	Superior	G.M. HUMPHREY	46.9	85.6
July	34	360°	0000	30	Huron	ROBERT C. STANLEY	44.6	82.7
August	45	240°	0400	16	Michigan	JOHN G. MUNSON	42.2	87.3
September	55	080°	1800	18	Michigan	HERBERT C. JACKSON	45.8	85.0
October	46	200°	1800	24	Michigan	MESABI MINER	45.9	85.5
	46	190°	1200	30	Superior	CHARLES M. BEEGLY	47.3	87.2
November	56	190°	2200	08	Superior	ROBERT C. STANLEY	46.7	85.8
December	55	240°	0000	05	Michigan	CHARLES M. BEEGLY	45.6	87.0
Year	80	210°	1200	Jan. 26	Erie	J. BURTON AYERS	41.8	82.6

frontal waves were rippling along it. On the 13th one of these developed enough strength to persist near Quebec. At 1200 the northwesterly flow over the Lakes brought near gales to Lake Huron as measured by three ships. The remainder of the month the intense LOWs were far north of the Lakes. The highest wave was 11.5 ft on Lake Michigan late on the 12th by the LE-HIGH. On the 24th a record low temperature of 36°F chilled Alpena, Mich.

#### JULY

Periods of cool temperatures over the Great Lakes persisted into July. There were the usual heavy thunderstorms and all that is associated with them including funnel clouds. Weak LOWs and fronts passed over the Basin, but there were no intense cyclones with tight pressure gradients to produce high winds. The few re-

ports of winds greater than 30 kn were associated more with instability than the pressure gradient.

The MIDDLETOWN reported two funnel clouds, the first on the 25th on Lake Superior and the second over Lake Huron on the 27th. She reported 13-ft waves with the latter observation. The highest wind for the month was reported by the ROBERT C. STANLEY--34 kn on the 30th over Lake Huron.

Cool temperatures occurred on the 11th, 12th, 17th, and 28th. The morning of the 11th Chicago broke a 105-yr record with 50°F. Frost hit areas of lower Michigan. On the 28th in the heat of summer, the temperatures in many areas in Michigan dropped into the mid-40's.

On the evening of the 26th a squall line with severe thunderstorms hit the Detroit River and Lake St. Clair. Winds gusting to 70 kn hit the area. Many dollars of

Table 12. --Highest 1-min wind (kn) reported on the Great Lakes by U. S. anemometer-equipped vessels

Year	Lake Erie		Lake Huron		Lake Michigan		Lake Superior		Lake Ontario	
1941	W	42	WSW	50	NW	43	NNW	54	--	--
1942	WSW	52	WSW	56	WNW	48	S	62	--	--
1943	WSW	57	WNW	43	SSW	50	WSW	52	--	--
1944	NE	38	NW	37	WSW	48	NNE	42	--	--
1945	WNW	52	SSW	54	WNW	49	NW	52	--	--
1946	SW	50	W	46	S	44	NW	47	--	--
1947	NW	51	SSE	43	ENE	39	WSW	43	--	--
1948	WSW	40	NNW	51	NW	45	WSW	48	--	--
1949	W	52	NNE	50	NNW	43	N	52	--	--
1950	SW	70	NW	48	NW	49	NW	81 <sup>1</sup>	--	--
1951	WSW	37	WSW	50	SW	49	WSW	54	--	--
1952	SW	46	SW	57	SSW	44	WSW	45	--	--
1953	WSW	49	NW	45	NNW	46	ENE	50	--	--
1954	W	45	NW	45	E	48	N	43	--	--
1955	W	52	SW	57	WSW	58 <sup>1</sup>	NW	48	--	--
1956	WSW	46	W	43	SSW	46	N	50	--	--
1957	WSW	72	SW	54	WSW	49	W	47	--	--
1958	SW	61	SW	43	SW	52	SSW	54	--	--
1959	W	42	NE	50	E	48	W	54	--	--
1960	NE	55	WSW	49	NW	55	N	54	--	--
1961	W	50	NW	47	NW	48	N	57	--	--
1962	NW	52	WNW	63	NW	48	NNW	60	--	--
1963	NNW	74	NW	60	N	52	NNW	52	E	35
1964	WSW	68	W	72	NW	54	WSW	62	WNW	50 <sup>1</sup>
1965	WSW	60	WNW	95 <sup>1</sup>	ESE	52	SW	70	W	40
1966	ENE	49	NE	60	NW	57	NNE	61	W	39
1967	WSW	43	W	58	ENE	55	N	53	W	32
1968	W	63	NNW	44	WNW	46	NNE	55	SW	31
1969	WSW	44	NNW	46	NW	50	SSW	50	--	--
1970	W	52	W	62	NW	52	W	63	--	--
1971	SW	50	N	53	N	50	SW	56	--	--
1972	W	45	NW	56	N	54	NNE	60	--	--
1973	SW	45	ENE	44	NE	56	NE	50	--	--
1974	ENE	48	SW	47	SW	42	ESE	46	W	38
1975	NE	40	WSW	60	SW	54	W	50	NW	32
1976	W	48	S	56	NNW	55	NE	54	W	34
1977	WSW	44	SE	48	ESE	44	SW	56	NW	26
1978	SSW	80 <sup>1</sup>	ENE	50	E	55	S	56	WNW	33

<sup>1</sup> Highest for each lake

damage occurred in downtown Detroit, where 15 large glass panels were blown out of the Renaissance Center. Ten boats were swamped or overturned on the Detroit River and lower Lake St. Clair. The Coast Guard rescued 30 people from the water.

## AUGUST

Out of nearly 2,000 observations there were only 14 with winds greater than 30 kn. They were about evenly divided over all the lakes, except Ontario where there were no observations mailed in. These winds were generally associated with instability. There were two reports during thunderstorms and two with squalls. The highest wind was 45 kn on Lake Michigan reported by the JOHN G. MUNSON in a special 0400 observation on the 16th. Gusts to 51 kn were also included. At this time a 996-mb LOW was near Isle Royale, and a front was passing over Lake Michigan. On the 17th there were four other reports of winds over 30 kn on Lakes

Erie, Huron, and Michigan by three ships as the LOW moved northeastward. On the 28th a 1003-mb LOW moved across upper Michigan. During its transit near gale-force winds were measured on Lakes Huron, Michigan, and Superior.

Among some of the interesting aspects of the month was a waterspout which came inland off Lake Michigan on the 15th and damaged property in Oceana County. On the 19th another waterspout moved off Lake St. Clair and caused additional property damage. On the evening of the 22d thunderstorms dumped 5.79 in of rain on Duluth and caused widespread outages and flooding. This broke a 70-yr record for rainfall in 24 hr. Barnes, Wis., received over 7 in. On the 26th the locks at Sault Ste. Marie were closed because of zero visibility in fog.

## SEPTEMBER

A mean sea-level analysis covering the Great Lakes

Table 13.--Highest seas reported on the Great Lakes by National Weather Service cooperating vessels, 1978

Lake	Ship	Date	Height (ft)
Ontario	BENJAMIN F. FAIRLESS	November 15	8.0
Erie	HARRY COULBY	Oct. 7 and 28	11.5
Huron	CHARLES M. WHITE	January 11	18.0
Michigan	LEHIGH	October 24	19.5
Superior	CHARLES M. WHITE	January 3	19.5

Basin this month would probably show small HIGHS on both the north and south edges with a weak front running roughly east-west over the Lakes. There were more than five times as many observations of winds of over 30 kn this month than the previous 2 mo. The highest recorded wind was 55 kn on the 18th reported by the HERBERT C. JACKSON on Lake Michigan. The highest wave was 16 ft also on the 18th on Lake Huron by the CASON J. CALLAWAY. Special observations were sent on the 4th and the 11th from Lake Superior by the JOHN DYKSTRA and G.M. HUMPHREY for thunderstorms and winds up to 56 kn with 12-ft waves.

The meteorological situation with this storm, and the one that produced the greatest number of wind observations over 30 kn, was different in that the winds were easterly along the base of a HIGH over Hudson Bay. A front lay south of Lake Erie. The front connected two LOWs—one over the Gulf of St. Lawrence and the other over the mountain States. On the 12th the winds were 40 kn or more on Lakes Michigan and Superior. The A.H. FERBERT had 43 kn from 90° and 13-ft waves. Gales were blowing on Lake Huron. On the 13th they spread to all lakes. The HERBERT C. JACKSON had 44-kn winds from 70° over Lake Erie at 1200. The MIDDLETON reported squalls on Lake Superior. The HIGH was pushing southeastward. The CLIFFS VICTORY found 15-ft waves on Lake Huron. On the 14th the winds were shifting to the south-east. The LEHIGH was in a thunderstorm with 34-kn winds on Lake Huron. On the 15th the HIGH was off the coast, and a LOW was north of Superior.

This was another of those situations where HIGHS straddled the Lakes with a front between them. The highest wind of the month occurred on Lake Michigan on the 18th at 1800. The HERBERT C. JACKSON was near the Straits of Mackinac with 55-kn winds out of the east with heavy rain. These winds were mostly confined to Lakes Michigan and Huron. The CASON J. CALLAWAY was on Lake Huron at the same time with 45-kn winds and 16-ft waves. On the 19th the HIGHS weakened as a LOW moved northward west of Lake Superior. At the same time a weak wave developed on the front over Michigan.

On the 11th there was a waterspout over Lake Michigan west of Frankfort.

#### OCTOBER

The typical weather pattern this month would probably show a LOW over Quebec with a front extending southwestward over the Basin with high pressure over the southeastern States. The number of observations of winds over 30 kn almost doubled those of September, but the number over 40 kn remained nearly the same. This was probably indicative of more small LOWs moving

over the area as winter approached.

A 1001-mb LOW moved over Michigan on the 6th. The LEON FRASER was on upper Lake Michigan with 42-kn northwesterly winds. As the LOW continued eastward, the SAMUEL MATHER read 45 kn on Lake Superior. Lakes Erie and Huron caught winds in the 30's.

A LOW formed on a front northwest of Lake Superior on the 11th. The CHARLES M. WHITE ran into a squall line out of Duluth late that day. There were 40-kn or above winds on Lakes Superior and Huron on the 12th as the front swept through. At 1800 the ROBERT C. STANLEY was caught by 44-kn westerlies on eastern Lake Superior with 13-ft waves. On the 13th the 40-kn winds had moved to Lake Erie, where the HERBERT C. JACKSON had 44 kn. Late in the day the storm's influence had retreated northeastward.

A multicentered LOW was near Lake Winnipeg on the 24th. The southwesterly flow already covered the western lakes. The MESABI MINER was headed south on Lake Michigan into 46-kn winds and 16-ft seas. This was the highest wind for the month—a tie with an observation from a storm on the 30th. At the same hour the LEHIGH was only a few miles away with 20-ft waves, the highest for the month. The storm consolidated early on the 25th, and the center moved along 50°N. Gales were especially present over Lake Michigan, but also reached Lakes Superior and Huron. On the 26th 40-kn winds brushed Lake Erie, and the storm moved out of the area.

A high-pressure center moved over the Lakes on the 29th. On the 30th it was over Maine, and a LOW was south of Hudson Bay. A tight gradient between the two produced high southerly winds. The highest was 46 kn at 1200 on Lake Superior by the CHARLES M. BEEGHLY. About 50 mi south the MIDDLETOWN found 42-kn gales. On Lakes Michigan and Huron the winds were blowing in the 30's. By the 31st the two systems had moved eastward out of the area.

#### NOVEMBER

The sea-level pressure over the Great Lakes averaged higher than normal this month. The mean pattern showed a HIGH east of Lake Erie with a short-wave trough extending from eastern Hudson Bay down Lake Michigan. There were four significant storms that affected the Lakes. It was that time of year, November is traditionally a bad month. From the 3d to the 5th temperatures were in the 70°F range over the Lakes. Alpena, Mich., broke their record by 10° with 76°F. Many cities were above 70°F.

A LOW raced across central Canada to reach the eastern shore of Hudson Bay by 0000 on the 9th. At 2200 on the 8th the ROBERT C. STANLEY was hit by

56-kn southerly winds on Whitefish Bay. Two hours later the winds dropped to 41 kn and averaged near 40 kn as she sailed westward then north-northeastward until the 10th. Lakes Michigan and Huron both had 42-kn winds found by the MIDDLETOWN and JOHN DYKSTRA, respectively. The LOW had moved near Greenland on the 10th. But, in conjunction with a large HIGH over the western mountains, the gradient stayed tight over the northern part of the Basin.

At 1200 on the 13th a 1002-mb LOW was over Wisconsin that had come out of Utah. Gales were blowing over Lake Superior, and at 1800 the JOHN DYKSTRA had 44-kn winds out of the south. Twenty-four hours later on the 14th the storm was 986 mb east of James Bay. The CASON J. CALLAWAY had 47-kn westerly winds on Lake Michigan. By the 15th the storm's influence was out of the area, except for Lake Ontario where the BENJAMIN FAIRLESS measured 33 kn.

This storm moved northward from the Gulf Coast. It was 999 mb over northern Illinois at 1200 on the 17th. A squall line was reported over southern Lake Michigan. The JOHN MUNSON off Muskegon sent a special observation at 2100 of 48-kn winds gusting to 60 kn with 10-ft waves. During the afternoon the side-wheeler MARK TWAIN was blown over and sank on western Lake St. Clair. By 1200 on the 18th the LOW was near 50°N, and winds over 40 kn were reported on all the lakes. Lakes Erie and Michigan had the highest

winds of the month. The J. BURTON AYRES (Erie) had 45 kn and the JOHN G. MUNSON 48 kn (Michigan). There were 15-ft waves on Lake Michigan. The gales extended over Lake Ontario. Waves up to 10 ft were eroding and flooding the eastern shore of Lake Erie.

From the 19th until the 29th the Basin experienced only weak LOWs or HIGHs. At 1200 on the 29th a LOW was over Lake Superior that had come out of the Canadian Rockies. Winds were in the high 30's on Lakes Michigan and Huron. On the 30th they were the highest, especially over Lake Huron where the RALPH H. WATSON had 46 kn. On Lake Superior the ROBERT C. STANLEY measured 44 kn.

#### DECEMBER

There were not as many high-wind observations this month as last, but there also were not as many total observations as fewer ships were plying the waters. Low visibilities were now due to snow rather than fog.

On the 4th a small LOW from the Mississippi Valley moved northeastward across the Lakes. There were some wind reports in the 30's, but the real storm was moving in from north of Lake Winnipeg. By 1200 on the 5th the first storm had disappeared and the real one was 974 mb near James Bay. The HOMER D. WILLIAMS reported 45-kn winds and 15-ft waves on Lake Superior late on the 4th. The J.A.W. IGLEHART had



Figure 15.--The icebreaking capability of this new Canadian bulkcarrier ARCTIC will help prolong her season on the Lakes. Photo by Albert G. Ballert.



40-kn winds on Lake Erie. Earlier, she had reported a thunderstorm. The highest wind of the month--55 kn--was reported by the CHARLES M. BEEGLY on upper Lake Michigan at 0000 on the 5th. The seas were 13 ft. The airport at Buffalo measured 43-kn winds. Lake Huron had 44-kn winds. The stronger winds in this storm were in the southeast quadrant. By the 6th they were below 30 kn.

This storm also came from the vicinity of Lake Winnipeg. At 0000 on the 13th it was over Lake Superior. The THOMAS WILSON was on Lake Huron with 45-kn northwesterly winds late that day. Storm and lake-shore warnings were issued for Lake Erie. The JOHN SHERWIN struck an ice boom in the St. Marys River and sustained extensive damage. On the 14th the LOW was over the Maritime Provinces, but the pressure gradient remained tight north of a HIGH over the Midwest.

Early on the 17th a LOW crossed the Lakes, but the high winds were in the northwesterly flow and mainly over Lake Huron. At 1200 there were reports of 43 kn by the CHARLES M. BEEGLY and 42 kn by the G.M. HUMPHREY. There were gale reports on Lakes Michigan and Superior.

At 0000 on the 23d there was a relatively weak LOW

north of Lake Superior, but it produced 44-kn westerly winds for the BENJAMIN FAIRLESS on that lake. Minimal gales had been found on Lakes Michigan and Erie. There were isolated gale reports during the remainder of the month and much snow. The Welland Canal and St. Lawrence Seaway closed for the winter on schedule (fig. 15).

#### ACKNOWLEDGMENTS

An expression of appreciation is extended to the masters and mates aboard the Great Lakes cooperating vessels for their valuable observations and contributions to the National Weather Service observing program. Much useful information and photographs were obtained for this article through the courtesy of Albert G. Ballert and the Great Lakes Newsletter of the Great Lakes Commission. National Weather Service meteorological and ice data were provided by Daron E. Boyce of the National Weather Service Forecast Office in Cleveland, Ohio.

Of primary importance were the listings of wind, wave, visibility, ice, and special observations prepared by John Snelling of the Applied Climatology Branch of the National Climatic Center on which most of the specific weather information in this article is based.

## Hints to the Observer

### NONUNIFORM VISIBILITY

Visibility frequently is not reduced around the horizon circle in a uniform manner. Fogbanks, showers, or haze may reduce visibility in only a portion of the circle. When only a part of the horizon is obscured, a simple rule for reporting visibility has been formulated; Report the greatest distance objects are visible over one-half or more of the horizon circle. This is the definition of prevailing visibility or visibility index.

Let us look at two examples. In figure 16, at the time of observation, a fog bank has drifted in from

the northwest reducing visibility in one-half of the horizon circle to zero. The visibility observed in the other half of the circle is 4 mi. Since the observed visibility is within the range of 2 to less than 5 mi, Code Figure 96 under symbol VV on NOAA Form 72-1 (Ship's Weather Observations) is reported.

Figure 17 shows nonuniform visibility caused by various weather phenomena obscuring portions of the horizon. One quadrant of the horizon circle is relatively unobstructed with a visibility of 4 mi. In the

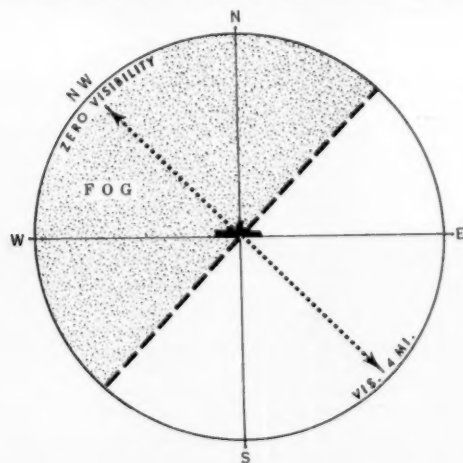


Figure 16.--Fog obscures one-half horizon circle.



Figure 17.--Various weather phenomena obscuring horizon.

southwest quadrant visibility is reduced to 3 mi by haze. Visibility is reduced by showers in the northern semicircle, with light showers in the northwest and moderate showers in the northeast. The observer can recognize objects at 2 mi to the northwest but only

at 1 mi to the northeast. Since the visibility common to one-half or more of the horizon circle is 3 mi, this is the prevailing visibility. Code Figure 96 is reported in the coded weather message.

## Tips to the Radio Officer

Thomas H. Reppert  
National Weather Service, NOAA  
Silver Spring, Md.

### COAST GUARD DISCONTINUES VHF-FM WEATHER BROADCASTS IN OREGON AND WASHINGTON

The U.S. Coast Guard has discontinued, on a trial basis, the scheduled weather broadcasts on VHF-FM Channel 22 (157.1 MHz). Mariners are requested to monitor the NOAA Weather Radio continuous weather broadcasts on 162.40 MHz (Channel 1) or 162.55 MHz (Channel 2). The Coast Guard will continue to provide special weather warnings as necessary. Comments concerning the discontinuance of routine weather broadcasts should be forwarded to: Commander (OC) Thirteenth Coast Guard District, 915 Second Avenue, Seattle, WA 98174.

### NOAA WEATHER RADIO

NOAA Weather Radio (NWR) station KHB 35, operated by the National Weather Service Forecast Office at Boston, Mass., will change frequencies from 162.40 (weather channel 1) to 162.475 (weather channel 3) effective July 16, 1979. This change will reduce the co-channel interface with surrounding NWR stations.

### NEW EDITION OF WORLDWIDE MARINE WEATHER BROADCASTS NOW AVAILABLE

The new edition of Worldwide Marine Weather Broadcasts, dated January 1979, has been distributed to ships participating in the Cooperative Observer Program and is available to the public from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When ordering, please refer to stock number 003-018-00095-4. The price is \$3.25.

### CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JANUARY 1979 EDITION)

#### Page 8

1-0010 Norfolk, VA NAM  
Delete time 0500, insert 0800

#### Page 9

1-0150 Boston, MA NMF  
Delete times 0050, 1650; insert 0000, 1450

1-0200 Portsmouth, VA NMN  
Delete times 0120, 1620; insert 0020, 1520

1-0210 Miami, FL NMA  
Delete times 0100, 1600; insert 0050, 1500

#### Page 10

1-0240 New Orleans, LA NMG  
Delete times 0020, 1720; insert 0100, 1550  
Delete frequency 428, insert 432

1-0270 San Juan, PR NMR  
Delete times 0120, 1620; insert 0030, 1430

#### Page 20

Guam, Marianas Islands NPN  
Add to (b) "Mainland, 62°E to 160°E."

#### Page 56

2-1510 La Jolla, CA WWD  
Add frequency 17408.6  
Add footnote 3, "Frequency 13147.5 used on request."

2-1530 Honolulu, HI NMO  
Delete times 0303, 0903, 1503, 2103; show frequency 2670 at times 0545 and 1745; delete footnotes 1 and 3.

2-1540 Honolulu, HI KBP  
Replace emission with A3J, A3A

#### Page 62

3-0020 Halifax, N.S. CFH  
Delete frequency 133.15, insert 122.5

#### Page 70

3-0330 La Jolla, CA WWD  
Delete time 1500, insert 1700; delete note after frequency 17408.6; amend footnote 4 to read: "On Friday, July through October, following weather analysis."

### CORRECTIONS TO RADIO STATIONS ACCEPTING SHIPS' WEATHER AND OCEANOGRAPHIC OBSERVATIONS

NMR - San Juan, P.R.  
Delete frequency 17002.4, insert 16983.2.

### ACKNOWLEDGMENTS

Thanks to Sidney Kirchner, SS EXPORT AIDE; Elvin J. Gaetz, S/T COASTAL KANSAS; James T. Ronan, SS EL PASO SOUTHERN; and A.L. Allen, SS PUERTO RICO for recent information relative to the marine weather program.



# Hurricane Alley

Dick DeAngelis  
Environmental Data and Information Service, NOAA  
Washington, D. C.

## TROPICAL CYCLONES OF THE SOUTHWEST PACIFIC-AUSTRALIA REGION, 1976-77

This summary is a combination of information from various sources. The major input is from the French magazine MET MAR January 1979 Bulletin No. 102. The information was kindly and expertly translated by Vicki Jones of NOAA.

Fifteen tropical cyclones developed in this region during the 1976-77 season. Six of these reached hurricane strength. This is slightly below the latest 12-yr average of 17 tropical cyclones, of which 7 become hurricanes. The most affected land regions were the Nouvelles-Hebrides and the Archipelago of French Polynesia.

The tracks (fig. 18) and the accompanying table 14 provide the vital statistics for the season.

One of the more interesting aspects of this season was the instruction cruise for young student officers aboard the helicopter carrier JEANNE D'ARC and its escort FORBIN. The main ship was outfitted with meteorological instruments and manned by specialists in maritime and tropical meteorology. The following are excerpts from their report as they roamed the South Pacific seas.

From Papeete to Noumea:

January 11--The meteorological situation in the southwest Pacific was characterized by a subtrop-

Table 14.--South Pacific-Australia tropical cyclones, 1976-77

Name	Minimum pressure (mb)	Maximum winds (kn)
1. Laurie	990	50
2. Kim	990	45
3. Ted	950	100
4. Irene	970	85
5. Marion	975	65
6. June	975	70
7. Keith	988	50
8. Miles	992	45
9. Karen	988	60
10. Otto	985	60
11. Norman	984	50
12. Pat	990	45
13. Leo	979	70
14. Robert	972	80
15. Verna	988	60

ical anticyclone which extended from the Lord Howe Islands to the Kermadec Islands. We observed a depression north of the Nouvelles-Hebrides; a minimum of 1000 mb around which winds of 10 to 15 kn took on a cyclonic turning.

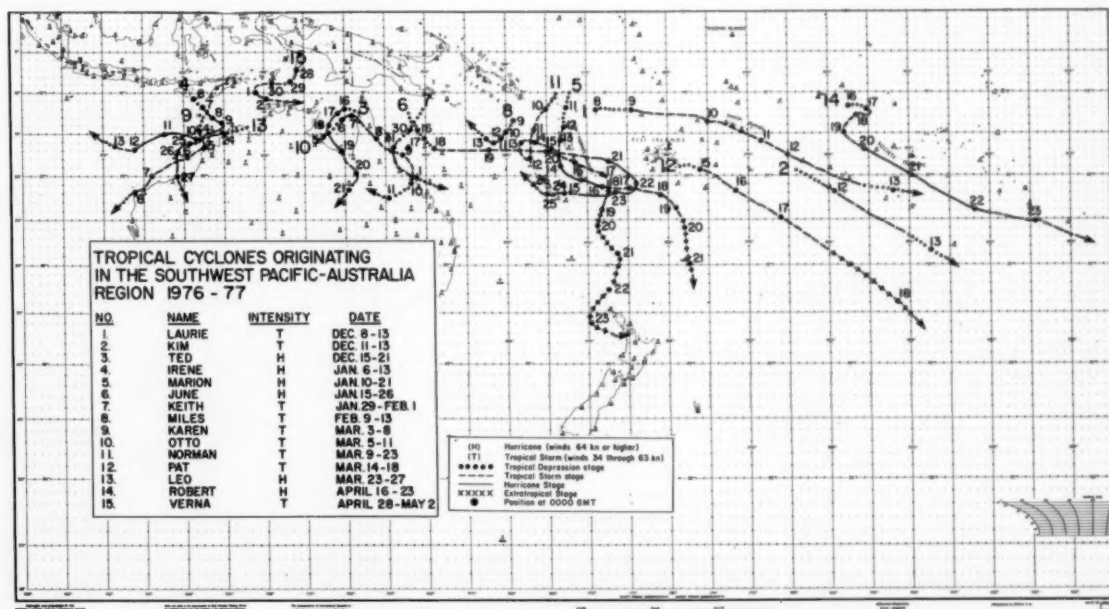


Figure 18.--Tracks of tropical cyclones in the southwest Pacific-Australia area, 1976-77.

January 12--At 0000 this tropical depression was displaced toward the south while deepening to reach 990 mb. She was then baptized Marion and her evolution was followed by the meteorological service of Noumea and by satellite photographs.

January 14-15--Marion turned toward the southeast, passing to the stage of tropical storm with winds on the order of 40 kn, before rapidly gaining cyclonic intensity with a pressure at the center estimated at 970 mb. To avoid passing less than 150 mi from the eye, the Group increased speed and steered to the southwest at 18 kn. Because of this, the Group was always more than 200 mi from the center of Marion and did not suffer her influence except on the 15th when they registered strong precipitation, average winds of 38 kn with gusts of 50 kn, and a strong sea with crests of 12 ft.

From Noumea to Sydney (January 20-24):

A second tropical depression named June formed west of the Nouvelles-Hebrides and only affected the area north of these islands, reaching her stage of maturity between these islands and the Fiji Islands. The passage was accomplished along the edge of a subtropical anticyclone with relatively good weather.

From Sydney to Darwin (January 28-February 5):

Up to the 22d weather over the Great Coral Reef and to the south was under the influence of a high, while a depression deepened in the north near 14°S and 148°E. This moved rapidly toward the south and reached the Australian coast on the 19th with a central pressure of 998 mb. Winds of 35 to 40 kn

blew during 48 hr up to a distance of 60 mi from the center. This tropical storm, named Keith, which never reached the stage of hurricane, slowed the progress of the Group in the channel of the Great Barrier Reef. The strong precipitation that accompanied this phenomenon reduced the visibility to less than 1 mi. The Group got wet during the night of January 31 and February 1 at 180 mi from Keith which penetrated land to die rapidly near Townsville. The next day the pressure increased regularly, the sky became clear, and the Group started its route in the direction of Darwin.

#### SOUTHERN HEMISPHERE MARCH AND APRIL 1979

During this period the Southern Hemisphere usually spawns six tropical cyclones, two or three of which become hurricanes. True to form this March and April saw six storms develop, and three reached hurricane intensity (fig. 19). Hazel, Ivan, and Meli developed in March; while Idylle, Jane, and Stan made appearances in April.

Hazel came to life on March 9 in the Timor Sea. She moved slowly, but developed rapidly. By the 10th Hazel was generating 65-kn winds near her center, and gales extended 140 mi in all directions. Her winds peaked at 70 kn on the 12th. Hazel paralleled the coast of Western Australia until the 14th, when she roared inland near Dangara, some 150 mi north of Perth.

Hazel was followed by Ivan, who developed in a sparsely traveled section of the South Indian Ocean and did not reach hurricane strength. Ivan began life about 250 mi west of Cocos Island. On the 18th his winds hit 60 kn, approaching hurricane strength. However, the following day they tailed off, below 50 kn. By the 20th satellite data indicated a well-defined surface center but little circulation or outflow aloft. This spelled

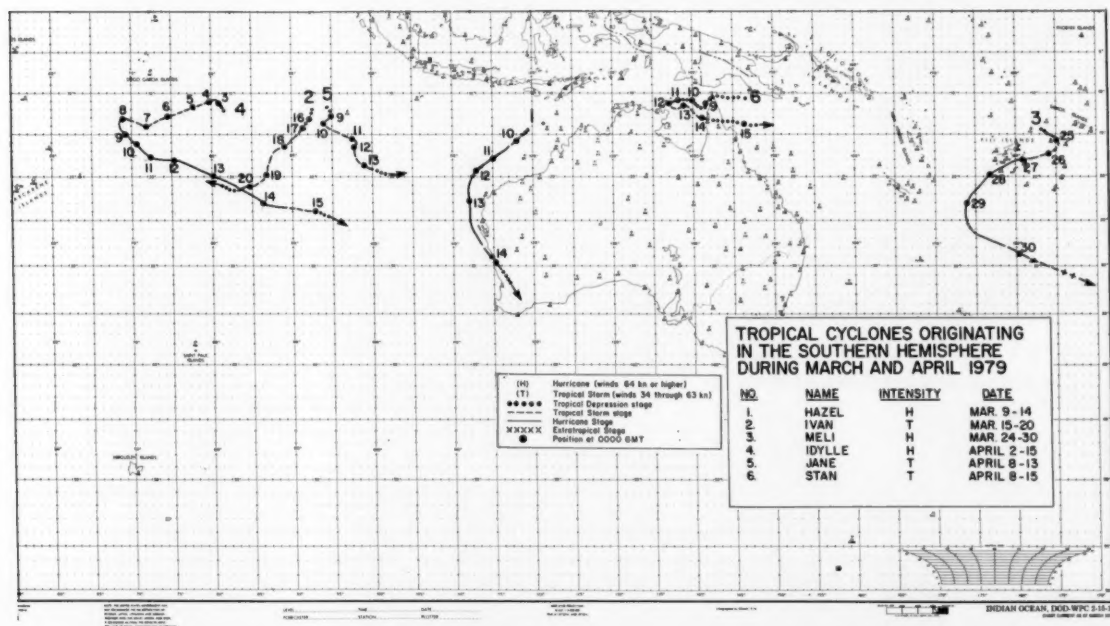


Figure 19. --Tracks of tropical cyclones in the Southern Hemisphere, March and April 1979.

doom for Ivan, the not so terrible.

Meli was born in the South Pacific between Samoa and the Fiji Islands. In less than 2 days she was a raging hurricane. From the 26th through the 28th Meli carved a narrow but devastating path through the Fiji's. Hardest hit were the islands of Thithia, Nayau, Moalu, Kandavu, and Vatulele. Thirty-one people died on Kandavu. Of these 21 were killed when the walls and roof of a church collapsed on them. Fourteen people died on Nayau. The death toll is not yet final. At least 11 vessels were lost or damaged. The NAM HAE 202, a 159-ft Korean fishing vessel, was lost with 20 crewmen aboard. The 3,179-ton freighter CENPAC ROUNDER ran aground on a reef off the northwest coast of Vatulele after leaving Suva, late on the 27th, to ride out the hurricane at sea. Her hull suffered extensive damage. A man and a young woman drowned after their yacht, anchored 200 ft off Kandavu, capsized in 90-kn winds late on the 27th. Once Meli moved away from the islands she began to recurve and weaken. By the 30th winds were down to 45 kn and she was turning extratropical.

The April storms all formed early in the month. Idylle, the blockbuster, popped up on the 2d south-east of the Diego Garcia Islands. Fortunately for the islanders, she headed west-southwestward before recurving on the 8th, after reaching hurricane strength. About this time tropical storm Jane came to life west of Cocos Island, while Stan began to organize in the northern Coral Sea. Idylle's winds climbed to 130 kn on the 11th as she became a particularly strong storm for this part of the world. Gales extended out 260 mi in all directions. Some 1,500 mi to the east, Jane

was generating 40-kn winds; while Stan, roaming the Gulf of Carpentaria, managed to become a minimal tropical storm. Idylle began to weaken on the 12th. The following day winds dropped below 100 kn, and by the 14th they were below hurricane force. Jane had dissipated by this time, while Idylle and Stan both held on until the 15th.

#### TYPHOON NAMES - 1979

The following is a list of names for tropical cyclones originating in the western and central North Pacific Ocean (east of 140°W). This is the first year for the alternate male-female storm names. Guam must have been gun-shy because they mistakenly used Alice instead of Andy. By the time Cecil rolled around, however, they had accepted the idea that boys are here to stay.

Andy	Owen	Herbert
Bess	Pamela	Ida
Cecil	Roger	Joe
Dot	Sarah	Kim
Ellis	Tip	Lex
Faye	Vera	Marge
Gordon	Wayne	Norris
Hope	Abby	Orchid
Irving	Ben	Percy
Judy	Carmen	Ruth
Ken	Dom	Sperry
Lola	Ellen	Thelma
Mac	Forrest	Vernon
Nancy	Georgia	Wynne

## On the Editor's Desk

### PORT METEOROLOGICAL OFFICER SETS RECORD

Anthony Rippo, Port Meteorological Officer (PMO), San Pedro, Calif., has passed the 20-yr mark in service to vessels arriving in the Los Angeles/Long Beach area. Since Tony (fig. 20) averages about 1,800 visits a



Figure 20.-- Tony Rippo flashes his winning smile which has greeted a record number of cooperating ship officers.

year and held the same job in San Francisco for 3 yr before moving to Long Beach in 1959, he has boarded well over 40,000 ships and climbed nearly 400 mi of ladder as a PMO. This is certainly not the extent of his marine experience, however. Before becoming a PMO, Tony sailed for 5 yr on weather ships of the Pacific Weather Patrol. He has also tried his luck as a tuna fisherman and was in the Merchant Marine for a brief period before being drafted into the Army in 1943. He worked as an apprentice shipwright in San Pedro after the war until he joined the Weather Bureau in 1947. Tony has been recognized by the National Weather Service for Outstanding Performance in 1961, 1968, 1971, 1974, and 1978. In 1973 he was awarded the Department of Commerce Bronze Medal "for individual leadership in the program to recruit cooperating merchant ships into the marine weather reporting service."

### NEW PHONE NUMBER FOR NEW ORLEANS PMO

The telephone number for David Shawley, the Port Meteorological Officer in New Orleans, La., has been changed to 504-589-2669.

### PORT METEOROLOGICAL OFFICER DROWNS

Robert Tubella, Port Meteorological Officer at Oakland, Calif., died May 20, 1979, in a drowning accident when his fishing boat overturned near the tanker

piers at Benicia. Bob was born December 20, 1930, in Boston, Mass. In 1948 he joined the Air Force and served in the Air Weather Service for 18 yr before accepting appointment to the National Weather Service's Office of Hydrology in Washington, D.C. Bob received a Special Achievement Award for Superior Performance as a Hydrological Technician in 1976 and a year later participated in a NOAA Unit Citation awarded to the Forecast Office at Charleston, W.Va. Transferring to Burlington, Vt., as a Weather Service Specialist, Bob again participated in a group award and NOAA Unit Citation for superior performance of duties at the Weather Service Office, Burlington, during the severe winter of 1977-78. Bob transferred to the NWS Western Region last August as the Port Meteorological Officer for the San Francisco Bay area.

#### NEW SCHEDULE FOR LORAN-A SHUTDOWN

A 6-mo postponement of the scheduled shutdown of U.S. Loran-A radio navigation service in several major coastal areas has been approved by the Secretary of Transportation. The U.S. Coast Guard made the recommendations to set new winter closing dates that would be less disruptive to maritime operations. The Secretary approved the following schedule for the closing of the stations:

- Hawaii and the Aleutian Islands--July 1, 1979, as planned originally;
- Gulf of Alaska and West Coast stations--December 31, 1979; and
- Atlantic, Gulf of Mexico, and Caribbean (West Indies) stations--December 31, 1980.

The current electronic system using shorebased radio transmitters and shipboard receivers to enable ships to locate their positions at sea is being replaced by the newer, more accurate Loran-C system, which is being expanded throughout the coastal waters of the continental United States and southern Alaska.

Loran-C will overlap Loran-A until termination of the latter is completed. After Loran-A is discontinued, only Loran-C will be available.

Loran-C's accuracy and dependability have already been proven on the West Coast and in the Northeast. It will give mariners a definite advantage over Loran-A.

A Coast Guard-funded study of problems associated with Loran-A termination, conducted by Oregon State University, pointed out that planned termination dates coincided with peak operating seasons for most commercial fishermen and many other users of Loran-A. The study recommended that the closing be rescheduled to a period of relatively low maritime activity.

Consultation with Sea Grant marine extension agents in all coastal areas confirmed Coast Guard expectations that termination of Loran-A would be least disruptive to maritime operations during winter months. However, the Coast Guard found no evidence that extension of Loran-A in the Aleutian and Hawaiian Islands would be beneficial.

#### COAST GUARD REQUIRES LORAN-C

The U.S. Coast Guard published in the May 31 Federal Register an interim final rule requiring vessels of 1,600 tons or more to install a Loran-C or specified

alternative electronic navigation receiver. This rule is applicable to all such vessels calling in ports in the continental United States, including Alaska. The effective dates are:

June 1, 1979, for tank vessels of 10,000 tons or more;

June 1, 1980, for other vessels of 10,000 tons or more; and

June 1, 1983, for vessels of 1,600 but less than 10,000 tons.

The Coast Guard recognizes the impracticality of full compliance by the June 1, 1979, date due to the short notice given to the public. Although it says it must cite vessels for noncompliance, no penalty will be assessed until November 30, 1979.

#### DATA BUOY NETWORK TO BE ESTABLISHED IN GREAT LAKES

NOAA's Data Buoy Office (NDBO) is planning to establish a network of eight buoys over the next 3 yr to support National Weather Service data requirements in the Great Lakes (fig. 21). For the first 2 yr, one buoy will be deployed each year in Lake Superior, Lake Michigan, and Lake Huron. During the third year, one additional buoy will be deployed in both Lake Superior and Lake Michigan. The planned operational season for the buoys is the relatively ice-free times in the Lakes from early April to mid-November, although this may vary with conditions from year to year. The buoys will be recovered and stored on shore during the most severe winter months.

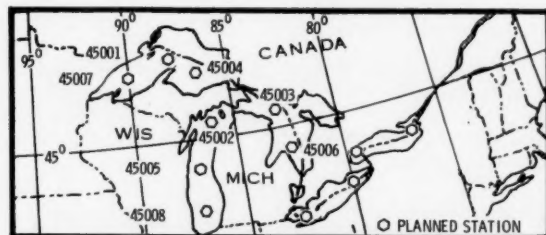


Figure 21.--Locations of the planned buoy stations.

The buoys that will be used initially are the all-aluminum NOMAD boat-shaped hulls (fig. 22). These hulls are 20 ft long with a 10-ft beam, 5-ft draft, 2-ft freeboard, and a 16,000-lb displacement. A combination chain/synthetic line mooring will anchor the buoys. The automatic weather monitoring system will be battery powered, utilizing the newly developed NDBO General Service Buoy Payload. Each buoy will report windspeed and direction, barometric pressure, dry bulb air temperature, surface water temperature, maximum wind gusts, and one-dimensional wave spectra (from which significant wave height and period are obtained). Buoy position will be reported for NDBO use by a separate radio satellite system. The payload is also equipped to accommodate subsurface temperature measurements.





Figure 22. --This photograph shows the type of NOMAD buoys that are being installed in the Great Lakes.  
NASA Photo.

The radio link from the buoys will be UHF via the GOES satellite. The data will be received at Wallops

Island, Va., sent to the National Environmental Satellite Service data collection and control center in Suit-

land, Md., then to the National Meteorological Center in Suitland, Md., for processing, and finally disseminated over the Weather Service circuits. During the first year of operation, the buoys will report synoptically every hour; thereafter, they will report on a 3-hr synoptic basis, with hourly reports available on command during severe conditions.

The buoys will be staged out of the Coast Guard Base at Sault Ste. Marie, Mich. Deployment, recovery, and service visits will be accomplished by NDBO personnel supported by Coast Guard cutters stationed in the Great Lakes. The first buoy in the network was deployed on station 45001 (48°N, 87°35'W) on May 24 from Sault Ste. Marie by the Coast Guard cutter MESQUITE. The next stations to be established in the network will be 45002 (45°17'N, 86°17'W) in Lake Michigan and 45003 (45°30'N, 83°12'W) in Lake Huron later in the year. The hulls chosen for these stations are now in use by NDBO at other sites, but will be retrieved and reconfigured at the NDBO facility in Mississippi and shipped by rail or truck to Sault Ste. Marie.

#### INSTRUMENT MEASURES WINDS FROM OCEAN BOTTOM

University of Rhode Island (URI) oceanographers have developed an instrument which, placed on the sea bottom, measures ocean background noises caused by the wind.

It has been known for years that both wind and rain produce high-frequency background noises in the ocean. Experiments have shown that anywhere in the ocean this background noise can be measured and used to determine windspeed at the ocean surface.

The instrument, called WOTAN (Weather Observations through Ambient Noise), is basically a hydrophone which "listens" to noise at three frequencies: 4.3 kHz, 8 kHz, and 14.5 kHz. To distinguish wind from rain, noise is compared at two frequencies, since noise caused by rain will be the same at each frequency while wind-caused noise levels will differ.

WOTAN was developed by the URI oceanographers after initial tests conducted by a URI graduate student in 1977 indicated that windspeed and background noise levels in the ocean were related. The instrument was tested last summer off Scotland during a joint United States-European study on air-sea interactions. The results showed that records from the instrument, placed on the sea floor 1-1/2 mi below a surface windspeed indicator, matched the surface windspeed record. Currently, the instrument is being used in a similar experiment in the equatorial Pacific.

WOTAN could become a useful tool for oceanographers who study how winds transfer energy into the ocean and thus drive ocean currents. Historically, windspeed has been measured from a ship or by a moored instrument. WOTAN can stay on the bottom where conditions are not as harsh, so it lasts longer; it is simple in concept and inexpensive to build.

Investigations into improving the technique of matching windspeed and background ocean noise are continuing at URI. They are now trying to find a way to determine wind direction from the same instrument.

#### IMPROVEMENT IN STORM SURGE FORECASTING

A new technique has been developed for forecasting of storm surges on Lake Erie by David Schwab, a researcher at NOAA's Great Lakes Environmental Re-

search Laboratory in Ann Arbor, Mich. He has devised a mathematical model which utilizes forecasted winds to predict storm surge on Lake Erie. Prior to this time most storm surge prediction techniques were based primarily on atmospheric pressure.

Storm surges are radical changes in water level, usually caused by a major storm passing over a body of water. In Lake Erie, because of its shallow depth and east-west orientation, a storm can cause the water to pile up at one end of the lake while dropping at the other. About once a year, Buffalo experiences a storm surge with water levels there rising more than 4.6 ft (1.4 m), while the water level at Toledo--on the other side of the lake--may drop by the same amount.

Buffalo's steep shoreline usually protects it from flooding, but sometimes the wind blows from east to west, and low-lying areas of Toledo may flood, especially if the mean lake level is already high.

To develop the model, the historical records on water levels, winds, and wind forecasts were examined, and storm surges were mathematically simulated. The simulations generally compared favorably with actual conditions that developed.

The experiments revealed several peculiarities in the storm surge process. Local variations in winds had as much effect in creating a storm surge as did large-scale wind patterns, and the difference between air and water temperatures greatly affected the wind's effect on the lake.

#### SHIPWRECKS, CORAL REEFS DISCOVERED OFF KEY LARGO

An extensive deepwater coral reef system and what may be as many as six shipwrecks, some perhaps dating back to Spanish exploration in the mid-seventeenth century, have been discovered in waters off Key Largo, Fla.

A team of NOAA marine scientists is investigating more than 50 mi<sup>2</sup> of the Key Largo Marine Sanctuary aboard the NOAA research vessel PEIRCE. NOAA is responsible for managing the sanctuary, one of two in the country, as part of its charge to protect environmentally sensitive coastal waters.

Although a number of sunken ships already have been located in the 100 mi<sup>2</sup> marine sanctuary and the area was known to contain uncharted coral reefs, the extent of the reef system and the number of newly found wrecks came as a surprise. Preliminary studies of a side-scan sonar record indicate an undiscovered reef system about 14 mi long that may be almost as large as shallow water reefs that already have been identified. The sonar record, which shows an almost photographic picture of the ocean bottom, also clearly indicates at least four, and possibly six, shipwrecks lying in 120 to 300 ft of water.

One of the wrecks is about 190 ft long. Its size and shape suggest it is probably a freighter sunk within the past 30 yr. However, at least one other wreck shows up on the sonar record as the badly deteriorated skeleton of a wooden ship about 80 ft long.

Although it is emphasized that without further investigation the identity of the wooden vessel, as well as the other wrecks, remains a mystery, on at least two occasions in the 1600's, large flotillas of Spanish ships were lost in storms near the Key Largo sanctuary. Few of these vessels have ever been found.



NOAA researchers have teamed up with scientists from a Florida-based oceanographic research organization to get a closer look at the reefs and the wrecks. Using a submersible, divers will carry out a scientific collection of fish and coral samples from the area.

#### COLD-WATER "DROWNINGS" NEED NOT BE FATAL

With summer weekends at the beach approaching and thousands of swimming pools being filled for the season, scores of men, women, and children will drown during the next few months in water accidents. But research supported by NOAA's National Sea Grant College Program shows that not all the drownings need result in death. The lives of some "victims" can be saved.

Dr. Martin J. Nemiroff, a University of Michigan researcher funded by NOAA, has determined that if a person "drowns" in cold water--water cooler than 70°F--he or she stands a good chance of being saved without brain damage, even after prolonged submersion.

A reflex common to marine mammals also occurs in humans in cold water. The body shuts off the flow of oxygen in its system to all but the vital parts--the heart, lungs, and brain. These conclusions are based on investigation of more than 200 drowning cases in the past 3 yr.

Nemiroff has been involved personally in 22 of the cases. In each instance the victim had been submerged in cold water for at least 5 min, was not breathing, haddilated pupils, and most had no pulse--all signs of death. Prior to these findings, it is doubtful resuscitation attempts would have been made. After prolonged resuscitation of the victims, 17 recovered fully, 3 did not respond, and 2 responded but suffered physical damage. One of the victims, a college student who had been underwater for 38 min, not only recovered fully, but went on to establish an A-minus record in college, evidence that no brain damage had occurred.

In cold-water drowning cases, it is important that resuscitation be started as quickly as possible, using any of the standard techniques taught by the American Red Cross, the Heart Association, or other organizations. It is also important that the resuscitation effort continue as long as the person administering it can physically perform the task or until professional medical assistance arrives.

The drownings studied have happened not only in lakes, oceans, or rivers, but in swimming pools as well. Many children fall into pools while they are being filled, and in most cases the water temperature during filling is about 60°F, cold enough to trigger the "mammalian response" which raises survival odds.

One child revived recently had fallen headfirst into a water-filled diaper pail while the mother was out of the room. The child was in the water which was less than 70°F for at least 10 min before the mother returned and started resuscitation. Through her efforts and those of a medical team called to the home, the child made a full recovery.

#### TRANSPORTATION ACCIDENTS, 1978

Transportation accidents in the United States killed 55,083 persons in 1978, nearly 2,000 more fatalities than in 1977, according to preliminary statistics released by the National Transportation Safety Board. This is an increase of nearly 4 percent over the 1977

## TRANSPORTATION FATALITIES \* 55,083 IN 1978

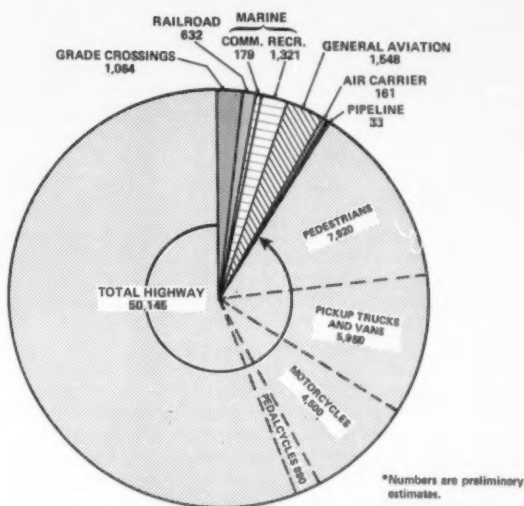


Figure 23. -- Fatalities for 1978.

death toll of 53,141--the second significant rise in as many years.

Highway deaths, which topped 50,000 for the first time in 5 yr, were the transportation fatality pace-maker. The 50,145 highway deaths, up nearly 5 percent over 1977, represented the third successive annual increase and the worst year since the oil embargo and reduction of the national speed limit to 55 mi/h.

The Safety Board Chairman termed the 1978 statistics "very simple and very frightening." Everywhere except on highways and at rail-highway grade crossings, fatalities decreased in 1978. But an additional 2,332 deaths in highway and grade crossing accidents more than offset fatality reductions in aviation, pipeline, marine, and railroad accidents.

What is frightening is the apparent determination of the motoring public--everyone who operates any type of motor vehicle--to go steadily back to the old days of faster driving and high-speed crashes.

Grade crossing fatalities in 1978 totaled 1,064--a 6-percent increase over 1977.

Of the modes registering fatality decreases in 1978, aviation and pipeline transportation achieved the largest safety gains. Aviation's total of 1,709 fatalities was a 16-percent decrease, with air carriers' drop from 654 to 161 more than offsetting an increase in general aviation (nonairline) fatalities from 1,395 to 1,548. Pipeline deaths dropped from 43 to 33, down 23 percent.

Rail and marine fatalities decreased 2 percent each. The rail total of 632 included 569 crew, pedestrian, and other deaths in intercity service; 13 intercity passenger fatalities; and 50 deaths in rail rapid transit. The marine total of 1,500 included 179 deaths in commercial operations and 1,321 in recreational boating.

The Safety Board's statistics were issued in the form of its annual pie chart of transportation fatalities (fig. 23).

# MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

## Smooth Log, North Atlantic Weather January and February 1979

**S**MOOTH LOG, JANUARY 1979--The storms followed climatology only relatively close this month. The primary path was over the U.S. East Coast to south of Kap Farvel, where the path split with a northern branch into the Labrador Sea and a northeastern branch into the Norwegian Sea. Other primary paths were from south of Iceland toward the English Channel and midocean eastward to the Iberian peninsula. The two are secondary paths according to climatological records. Several low centers stalled near Newfoundland and dissipated as other centers developed.

In contrast the month's mean sea-level pressure had very little resemblance to the climatological mean for the month. The gross climatological mean shows a 1001-mb LOW near 60°N, 35°W; a secondary 1005-mb LOW near 68°N, 00°; and a band of high pressure with several centers along latitude 30°N. This month the Icelandic Low was broken into four centers. The deepest was 1007 mb near the location of the secondary climatological LOW. There were two 1011-mb centers near Kap Farvel and 45°N, 58°W. There was also a 1012-mb center near Cape Wolstenholme. Several cutoff LOWs produced a 1013-mb center near 35°N, 18°W. This month's mean high-pressure band was centered on about latitude 30°N, but the highest pressure of 1019 mb was south of Bermuda.

The largest anomaly center was plus 13 mb centered near 54°N, 32°W. The zero isoline hung like a slack rope from Ireland to Cabot Strait. It dropped to about 37°N at 40°W. There were two negative anomaly centers of importance--a minus 7 mb off the coast of North Africa and a minus 3 mb off Long Island.

The mean upper air pattern at 700 mb over the eastern United States resembled the climatological pattern, except the LOW center was 40 m higher over Foxe Basin. There was a short-wave trough evident southeastward from Cape Race. The climatic ridge normally over western Europe was centered along longitude 30°W this month with a short-wave trough where the ridge normally would be located. As with the sea-level pattern the anomalies were reversed in sign from what normally might be expected. A positive 104 m was near 55°N, 38°W, a minus 71 m was off the coast of North Africa, and a minus 53 m was over Iowa.

**Extratropical Cyclones**--In general the northern shipping lanes were influenced by high pressure the first

2 weeks of the month. The HIGH built to 1040 mb by the 10th near 40°N, 30°W, before gradually giving way by the 13th. Early in the first week there were two LOWs east and southeast of the high pressure. Other LOWs moved eastward across the top of the HIGH.

Rivers in the Midwest had their problems again this month. There was a 126-mi ice jam on the Mississippi River between St. Louis and Cairo, Ill. (fig. 24). The river was closed to traffic on the 18th and did not reopen until the end of the month. The Coast Guard with commercial towboats and tugs worked to breakup the ice jam. This is the third consecutive winter in which severe weather has closed this part of the Mississippi River to traffic. At this time the Ohio River was not severely affected, but it was later in February.

There were large HIGHS over North America and Europe on the 2d. One HIGH was 1044 mb over Texas. This brought strong northerly winds over the Gulf of Mexico and produced 35 mi/h winds on the eastern Mexican coast. The 1200 chart indicated Veracruz had 60 mi/h winds. Three ships had winds over 40 kn including the RICHARD with 18-ft waves. The buoys were measuring 35 kn. The presence of a Tehuantepecer off the southern coast over the Gulf of Tehuan-



Figure 24.-- An ice jam on the Mississippi River at mile 80.8 near Grand Tower, Ill. U.S. Coast Guard Photo.

tepec was verified by 60-kn northerly winds and 20-ft waves reported by the AMERICAN ASTRONAUT. Also, there was high pressure off the east coast of the United States and the west coast of Europe and North Africa. A LOW formed between these two high pressure centers and moved eastward. At 1200 on the 3d, the 990-mb storm was near 48°N, 14°W. The BRITISH DRAGOON near 47°N, 07°W, was pounded by 60-kn winds. At 1800 OWS Romeo measured 48-kn winds with 30-ft seas. The DARINA near 49°N, 06°W, found 50-kn winds and 39-ft swells.

It was reported on the 4th that the storm contributed to 47 deaths across Europe. Only 2.5 in of snow fell in London, but it paralyzed the town. In Manchester 10 in of snow fell, and in Scotland drifts reached 10 ft. A whale in a dolphinarium on a pier in Clacton was rescued when a 60-ft wave nearly destroyed the pier. The cold weather brought ice to many areas. The excursion boat APHRODITE was damaged by ice pushing her against a pier at the port of Damp in West Germany.

Early on the 4th Romeo was headed into 34-ft seas. At midday the 988-mb center moved inland near Bordeaux. The SUGAR CARRIER near 42°N, 23°W, was sailing northeastward into 25-ft northerly seas. The DARINA was entering the English Channel with 65-kn winds and 35-ft waves. On the 5th Romeo again had 33-ft waves. Late in the day another LOW formed off Casablanca, and this LOW dissipated.

As the storm moved into Spain and the next LOW formed off Morocco, cold air was pulled over Europe and the Mediterranean from Russia. During the past week Sicily had its first snow in 25 yr. Snowdrifts were 6 ft deep in Sweden. In southern England residents were evacuated from coastal towns. The Adriatic Sea had ice for only the third time in the past 40 yr. Far inland Moscow was having its coldest weather in 100 yr—minus 37°C (-35°F) in the center of the city. By the 7th at least 132 people in western Europe had died from weather-related causes. The Eiffel Tower was ice covered and closed to visitors for the first time in 40 yr. A Spanish freighter sank in the English Channel with only one member of the crew saved. There were five other ships that either sank or went aground during this storm. On the 3d the GERMA (1,240 tons) sank after the cargo shifted in heavy seas off Benghazi. The Cypriot YPOPTER-ARCHOS KATSOUFRIS ran aground in fog north of Safi. On the 4th the STABIA I (1,515 tons) was pushed into the breakwater at Salerno and sank. Three crew were dead and nine missing. The Greek CANTONAD (2,200 tons) developed a severe list and sank north of the Brest peninsula. Five bodies were recovered and 10 crew were missing. The 557-ton Lebanese KINANA ran aground north of Tripoli.

**Monster of the Month**—The day after New Year's a front paralleled the North American east coast along the Appalachian Mountains. This LOW developed from one of many frontal waves moving northeastward along the front. The KING COBRA was missing off Atlantic City, where she had reported high winds and heavy seas. On the 3d one LOW north of Sept-Îles dominated the scene. At 1200 on the 4th the 980-mb storm was over the Labrador Sea near 60°N, 56°W. Several Danish ships nearby had winds near 45 kn. At 1800 the PAMIUT near 64°N, 54°W, had 63-kn winds. This deep storm continued



up the west coast of Greenland, and as often happens another LOW formed near the southeast coast. At 1200 on the 5th this 974-mb storm was over the Denmark Strait. A buoy southwest of Iceland measured 45 kn. The Iceland fishing fleet was hard hit. One boat had 60-kn southeasterly winds off the northwest coast.

The cyclonic circulation with this storm covered an enormous area and encompassed several centers. Its circulation reached from Scandinavia to the eastern slopes of the Rocky Mountains and from near the North Pole to latitude 50°N on the 6th. The JOHN CABOT was east of Hopedale with 55-kn winds. Lima had 50-kn winds and 16-ft seas. The NURNBERG EXPRESS found 60-kn winds and 26-ft seas at 1800 near 56°N, 28°W. The KOPALNIA ZOFIOWKA (59°N, 05°E) also had 62-kn winds but reported no seas. On the 7th the GENE TREFETHEN (57°N, 24°W) had 33-ft swell waves on her stern. Lima still had 50-kn winds and 26-ft seas. The many ships and platforms in the North Sea were reporting 45- to 60-kn winds with the seas up to 30 ft.

This LOW was moving into Scandinavia and another had developed south of the Denmark Strait. OWS Charlie was broadcasting 20-ft waves. On the 9th Lima had 58-kn westerly winds and 23-ft seas. The second LOW had disappeared from the analysis. The strong gradient was now over the top of the HIGH rather than near the LOW. A ship had 20-ft seas near 48°N, 23°W. These moved to Lima and Romeo with 40-kn winds at 1200.

The LOW was elongated east-west from Nordkapp to Iceland. On the 10th this broke down into several low centers. One moved eastward from Ireland. Reporters on the North Sea were finding 40- to 60-kn winds with waves of 20 to 30 ft. A ship with the call letters DNCP at 48°N, 12°W, had 20-ft seas and 33-ft swells at 0900 which built to 33 ft and 49 ft, respectively, by 1200. At 1800 they had dropped to 33 ft. Early on the 11th the barge INTERMAC 600 capsized in the North Sea in force 10 winds and 40- to 45-ft seas. On the 12th this last LOW had moved far enough inland that the winds and waves had dropped to reasonable values. The HIGH had peaked at 1040 mb on the 10th and was drifting southeastward with the pressure falling.

This storm formed north of the Gulf of Mexico on the 13th and moved up the Ohio River Valley. It started to influence the eastern seaboard on the 14th with isolated gales. The DELTA BRASIL was on the Bay of Campeche with 50-kn winds and 13-ft waves under the influ-

ence of the HIGH following the LOW. The THOMAS F. PATTON on Lake Michigan measured 50-kn winds and 15-ft waves. On the 15th the winds increased to 40 to 50 kn as the storm crossed into the Labrador Sea near Goose Bay. The BALTIMORE TRADER was near Nantucket with 45 kn and 12-ft waves. At 1800 the LF3Q (44°N, 61°W) had 55-kn winds and 16-ft seas. A ship near 52°N, 42°W, had 45-kn winds and 23-ft seas on the 16th. The LONDON VISCOUNT had 65-kn southerly winds and 26-ft waves near 50°N, 39°W. OWS Charlie was recording winds of 45 to 50 kn and seas around 25 ft. The SHEAF ROYAL (40°N, 57°W) was slapped by 26-ft swells on her port bow. The CHASTINE MAER-SK, farther south near 35°N, 54°W, had 39-ft swells pounding her starboard beam. The storm was moving through the Davis Strait on the 17th and split into two centers. One remained stationary east of Cape Chidley for 24 hr, while the northern center moved over Devon Island. The DISKO was caught by a last swipe of 60-kn winds and 23-ft seas off Gothab.

This storm came to life over Missouri on the 17th. It was 998 mb near Sable Island on the 18th. The BALTIMORE TRADER had probably been in New York Harbor and was now outbound with 50-kn winds and 20-ft seas. On the 19th she had 55-kn winds and 25-ft seas. Buoy 44005 measured 48-kn winds and several ships reported winds near 60 kn. They were generally in the southern half of the storm and included the BREEHORN and the SUSAK. The H1070 near 46°N, 54°W, had 41-ft swell waves from the northeast.

There were reports of waves up to 25 ft on all sides of the storm on the 20th. The winds had decreased to 50 kn and below. On the 21st a secondary LOW formed southeast of Newfoundland as the original LOW died south of Kap Farvel.

This second LOW quickly developed a large circulation as three upper air LOWs consolidated into one over the Azores. Three ships in the southwest quadrant reported waves up to 25 ft on the 22d. One was the USNS YUKON. A French ship radioed 58-kn southeasterly winds near 35°N, 13°W, on the 23d, while the island of Madeira measured 40-kn winds. On the 24th the GANYMEDES had pounding 30-ft swells near 42°N, 17°W. The storm was weakening as it drifted eastward as another storm to the west was winding up.

There was a frontal system paralleling the Gulf Coast on the 20th with frontal waves rippling along it. One of these became a full-blown storm by the 21st and moved northeastward along the Appalachian Mountains. Southerly winds in the eastern hemisphere were already attacking shipping. The 10,343-ton ore carrier UNITED FAITH grounded in 55-kn winds at Cape Fear River, N.C. The MANICA (32°N, 77°W) suffered 55-kn winds and 20-ft waves. Nearby the CAROLINA also reported. The USNS AMERICAN EXPLORER was in the same vicinity (35°N, 74°W) with 30-ft seas and 38-ft swell waves. The next day the seas were still 30 ft and swells 35 ft. About dark on the 23d the MANICA was struck by 70-kn winds and 26-ft seas. Other ships were reporting waves over 20 ft. The storm was 978 mb over Maine on the 22d. It split into multiple centers on the 23d which spelled its doom.

The demise of two storms was the beginning of this one. As the last two described storms deteriorated,

this one arose to take their place. It was first located on the 1800 analysis of the 23d near 41°N, 45°W. There was already a northwestward and southeastward circulation established south and north of the center associated with the latter two storms. At 1200 on the 24th, the 970-mb center was near 44°N, 48°W. Winds up to 40 kn and seas to 20 ft were established. A French ship, the FNHM (40°N, 47°W), had 50-kn winds with 16-ft seas. The SUSQUEHANNA (35°N, 42°W) was sailing on a collision course with the storm while fighting 33-ft waves. The CRANIA (39°N, 40°W) with a pressure of 986 mb was almost in the direct center of the 985-mb storm with 31-ft southwesterly swells. The storm was moving east-southeastward with generally gale-force winds or less and seas below 20 ft. On the 27th the LOW curved more easterly and ended over Spain on the 28th.

This storm formed over the Southern Plains on the 22d. The low center was still over the Midwest on the 24th, but southerly winds were already influencing the waters off the coast. At 1800 the BOCKENHEIM had 58-kn winds off Norfolk. On the 25th the GYPSUM EMPRESS off Georgia was fighting 60-kn winds behind the front, and the BLACKFORD had 30-ft waves off Hatteras.

Storm warnings were posted for the New England coast on the 25th. Nantucket Harbor had gusts to 64 kn. Boston registered 50 kn. The storm's center moved over Long Island at 980 mb at 1200. Off the coast the AUSTRAL PATRIOT posted 25-ft waves. On the 26th the gradient south of the center relaxed, but there were some reports over 40 kn. On the 27th and 28th the storm dawdled near Cape Sable as another approached from the southwest.

The ancestral history of this storm goes back at least to the 23d. At that time there were three weak low centers aligned from the English Channel to the Greenland coast at 77°N. Snowfall of up to 12 in blanketed southern England bringing chaos to roads and railways. Motor organizations reported 500 mi of traffic jams. This large area of general low pressure persisted, expanded, and stretched from Africa to Spitsbergen. This LOW was born in a trough that stretched from the Shetland Islands to Kap Farvel. At 1200 on the 27th it was 980 mb near 60°N, 15°W. The buoy southwest of Iceland was reporting 40-kn winds. On the 28th OWS Lima had snow showers driven by 45-kn winds with 20-ft waves. The ASIA FREIGHTER and the C.P. DISCOVERER were in the vicinity of 52°N, 16°W, with 30- to 33-ft swell waves. The storm was centered over the Irish Sea on the 29th. A ship west of Lands End was sailing into 23-ft waves. The storm disappeared over the continent on the 30th.

This storm tracked along the beautiful white beaches of the Gulf of Mexico until it crossed northern Florida on the 27th. Once over the Gulf Stream, it intensified and moved rapidly northeastward. A U.S. Navy ship near 31°N, 74°W, had 40-kn winds and 20-ft waves. At 1200 on the 29th the storm was 960 mb south of Sable Island. The MAYAGUEZ and another ship not far from 35°N, 73°W, contended with 50-kn winds. These picked up to nearly 60 kn by the 30th. A SHIP near 36°N, 68°W, was buffeted by 20-ft seas and 33-ft swells. The MORMACSAGA (31°N, 56°W) fought 25-ft seas and 30-ft swells with only 45-kn winds.



SHIP'S NAME	CALL SIGN	MMSI (IMO 721-1)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE	GENERAL INSTRUCTIONS (See observing handbook for more details)	Form Approved, Budget Bureau No. 41-101-1
EXPORT CHAMPION	WLCC	171	SHIP'S WEATHER OBSERVATIONS	1. Fill in all blanks on upper left-hand side of this form. 2. Check appropriate line in column 22. 3. Before entering, convert: a. all temperatures to °C. b. all pressures to millibars. c. if conversion tables not available, enter values as observed.	(Indicated by letters or abbreviations for the first only on each line, ("73.5°N", "79.003 in.", etc.) 4. Begin a new sheet each month, voyage, season and quadrant. 5. Code for transmittance unobserved columns. See observing handbook, Chapter 1, for sailing messages and handling missing data.
MONTH AND YEAR	FROM	TO	CORRECTION APPLIED		
February 1979	Casablanca	New York	+0		
COUNTRY OF REGISTRY					
U.S.A.					
SHIP'S NAME	CALL SIGN	MMSI (IMO 721-1)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE	GENERAL INSTRUCTIONS (See observing handbook for more details)	Form Approved, Budget Bureau No. 41-101-1
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February 1979	Casablanca	New York	+0		
COUNTRY OF REGISTRY					
U.S.A.					
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MONTH AND YEAR	FROM	TO	CORRECTION APPLIED		
February 1979	Casablanca	New York	+0		
COUNTRY OF REGISTRY					
U.S.A.					

Figure 25. --An extract of the Ships' Weather Observations form from the EXPORT CHAMPION.

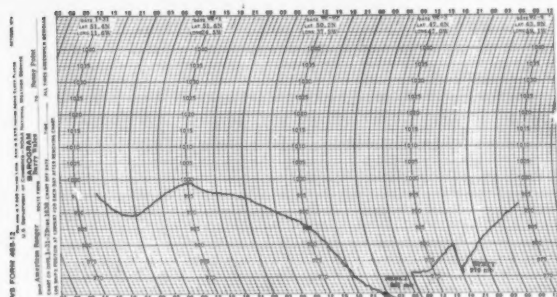


Figure 26.--The barograph of the AMERICAN RANGER had to be reset when the pen bottomed.

There were many winds of 40 kn or over and waves over 25 ft on the 30th. The SHEAF ROYAL (37°N, 67°W) had westerly winds of 64 kn, 59-ft seas, and swells of 49 ft at 1800. Six hours later the winds were 60 kn, but the waves had subsided to 36 ft. By 1200 on the 31st they had decreased to 52 kn and 30 ft. The storm was moving very slowly, and the SHEAF ROYAL was catching up with the center. The LAURENTIC near 32°N, 56°W, was 600 mi south of the 964-mb center with 60-kn westerly winds and 52-ft waves. The CHARLEROI went through the same area (32°N, 55°W) 6 hr later, but found only 39-ft waves.

This was the only storm from coast to coast between 20°N and 60°N. Gales were blowing from Cape Hatteras to Cabo Finisterre. A frontal wave came out of the Gulf of Mexico on the 31st and was racing into the storm's center. The 10,984-ton bulkcarrier MIT-SOS reported leakage and was listing 14 degrees about 1,000 mi southwest of the Azores. The crew of 27 was rescued by the JAMAICA PRODUCER on the 1st. Radar contact was lost and the vessel presumed sunk. At 1200 on February 1 this new storm was 970 mb near 38°N, 63°W. The SHEAF ROYAL was now involved with this system and 26-ft waves. The BALTIMORE TRADER (36°N, 73°W) was sailing homeward into 50-kn winds

and 33-ft waves. On the other side of the "pond" the SWEDISH WASA (47°N, 07°W) contended with 45-kn winds from the southwest, 30-ft seas, and 33-ft swells on her bow.

On the 2d the AQUILON, CHARLEROI, and SUGELA reported 65-kn winds, and the VATUTINO had waves up to 36 ft in the area from 30° to 36°N and 55° to 70°W. At 1200 there were two swell wave code 40 (66 ft) height reports from the CHARLEROI and the EXPORT CHAMPION. On the 3d the CHARLEROI had 56-ft waves near 31°N, 58°W, and the KIMITSUSAN (34°N, 54°W) had 61-ft waves. The storm was now 954 mb at 45°N, 45°W. Two ships reported 49-ft waves on the 4th—the ESCHERSHEIM (31°N, 52°W) and the GZON CHAMPION. A copy of the Ship's Weather Observations from the EXPORT CHAMPION revealed the 66-ft swells that were still occurring at 1800 and were up to 54 ft through 0600 on the 3d (fig. 25). The AMERICAN RANGER passed north of the storm's center at 0600 on the 3d and registered a low pressure of 961 mb until 1100, when the pressure started rising (fig. 26). On the 3d the CHARLEROI had 56-ft waves near 31°N, 58°W, and the KIMITSUSAN (34°N, 54°W) had 61-ft waves. The storm was now 954 mb at 45°N, 45°W. Two ships reported 49-ft waves on the 4th. They were the ESCHERSHEIM (31°N, 52°W) and the GZON CHAMPION. At 1200 the AQUILON (34°N, 40°W) radioed 80-kn winds just prior to passage of a trough.

On the 5th the EXPORT CHAMPION (38°N, 58°W) found 33-ft swells about 900 mi southwest of the 960-mb center. On the 5th and 6th the LOW began tracking westward. There were still strong winds and high waves. The OIHZ (38°N, 65°W) found 70-kn winds, and the SALLAND (36°N, 57°W) now was the one with 49-ft waves plus 60-kn winds. At 1200 on the 6th, the low center had retrograded to Newfoundland, and a new center formed in the circulation to the south. By 0600 on the 7th the older center had disappeared, and the new one was the storm of the hour.

**Casualties--**The 272-ft rig tender S. T. 95 with 28 peo-



ple on board was foundering in gale-force winds and 18-ft seas about 80 mi southeast of Cameron, La., on the 2d. Pumps were airlifted and the situation brought under control. On the same day the 5,588-ton tanker MASTER MICHAEL caught fire in the Caribbean Sea. Thirty crewmen who abandoned ship did not survive, but four of five that remained aboard survived. They were picked up by the passing Italian freighter ILICI. One man drowned while the men were swimming to the rescue ship.

The 13,804-ton French cruise ship MERMOZ was struck by high winds while entering Miami on the 4th. The vessel listed 12 to 14 degrees. On the 8th it was reported that two barges, the OCEAN STATE and the SEA STAR, were cut from their tugs during bad weather off Cuba. The WILSTAR (132,000 tons) limped back to Tunisia after an 8-m crack was discovered in its deck. It was thought that bad weather after sailing from Tunisia may have been involved.

The 15,600-ton bulkcarrier OGDEN IMPORTER arrived Holyhead, United Kingdom, on the 6th with heavy weather damage that occurred on December 27 to 29 and January 3 to 5. The 18,995-ton bulkcarrier CAPTAIN DEMOSTHENES struck the quay at Funchal in high gales and suffered indents. The wind swept three 30-ft containers into the sea and damaged six others. The 10,688-ton ROTHESAY CARRIER reported water damage to cargo in force 8 to 10 winds during the 3 days prior to arrival in Miami on the 25th.

The MARJORIE LYKES (8,762 tons) sustained surging damage on the 13th and 14th at Casablanca. The bulkcarrier GEMINI (15,287 tons) sustained ice damage on Lake Michigan about the 28th. The supply vessel OCEANUS sank in the Gulf of Mexico due to cargo shifting in heavy weather on the 31st. The 44,875-ton tanker KITTANNING was surveyed at Delaware Bay for heavy-weather damages that occurred on the 31st and February 1.

Some late-reported casualties. The Dutch ANNE BROERE (1,597 tons) developed a list in heavy weather in the Baltic on the last day of December and ran aground. She was later refloated but suffered extensive damage. The 8,275-ton Greek EUROWAVE ran aground in heavy weather on the 3d on the coast of Syria. The 639-ton Cypriot VULCAN ran aground in heavy weather at Crete and broke in two. The Brazilian cargo vessel BOA ESPERANZA (4,277 tons) encountered heavy weather on the 12th while on a voyage Baltimore to Brazil. The 8,782-ton Greek MIMOSA ran aground in heavy weather on the south coast of France on the 18th and broke in two. The crew was safe. The Dutch tug SMIT-LLOYD 47 dragged anchor at Peterhead on the 19th and ran aground. The 1,919-ton ASTIPALAI ran aground near Oran, Algeria, on the 28th. The 21,393-ton British tanker LONDON CONFIDENCE alleged heavy-weather damage during the 28th to 31st from St. Croix to New York.

**S**MOOTH LOG, FEBRUARY 1979--The storms this month were large and deep as would be expected in a winter month. There were two especially vicious storms that affected land areas--the east coast of the United States and central Europe. The storms generally followed climatology, moving from the Great Lakes into the Labrador Sea and off the U.S. East Coast toward Iceland. Generally, high pressure pro-

tected northern Europe, but one bad storm moved in on a more southerly track than usual. Another hugged the U.S. East Coast and produced havoc with heavy snow.

The Icelandic Low was 992 mb this month and over 400 mi south of its climatic position. This was 11 mb lower than its normal 1003-mb mean central pressure. A secondary 1004-mb Low was normally located off the northwest coast of Norway. The 1023-mb Azores High at 29°N, 20°W, was 10° longitude east of its normal 1020-mb position. There was sharp troughing off the U.S. East Coast as normal, with an additional trough over the central ocean at about 40°W. The large High over northwestern Canada extended its influence into the eastern United States.

The major anomaly and the one that dominated most of the Atlantic north of latitude 30°N was minus 16 mb near 47°N, 37°W. There was a plus 4-mb anomaly over the North Sea and a plus 3 mb near the Canary Islands. The pressure anomaly over the eastern United States ranged from plus 8 mb over the Great Lakes to plus 2 mb over Florida. The pressure over the Mediterranean Sea was as much as 7 mb below normal near Sardinia. It was also as much as 8 mb below normal over the central ice cap of Greenland.

In the upper air at 700 mb the major Low was 86 m deeper than usual near its normal position of 75°N, 85°W. There was a second abnormal closed circulation between Belle Isle and Kap Farvel. The major long-wave trough was over midocean near 45°W, rather than along the North American east coast. The ridge over the west coast of Europe was accented.

Extratropical Cyclones--During the first week of this month, the Atlantic was dominated by a large severe storm that had originated in January. It is described in the January Rough and Smooth Logs. That low center dissipated over Newfoundland on the 7th.

This LOW formed in a trough of the above storm and was first analyzed on the 0600 chart of the 6th near 41°N, 52°W. At 1200 its existence was noted by the high wind and wave reports from the OIHZ (70 kn) and the SALLAND (60 kn and 49 ft). Other ships also reported extreme winds and waves. The CHAMPLAIN (38°N, 62°W) had 65 kn and 49 ft, the EXPORT CHAMPION (39°N, 64°W) had 60 kn and 33 ft, the GOLDEN DOLPHIN (39°N, 60°W) had 50 kn and 39 ft, and the KIMITSUSAN MARU (34°N, 64°W) found 40 kn and 44 ft. By 1200 on the 7th this 965-mb LOW was near 46°N, 44°W. The highest wind report was 91 kn by the AMSTELBRINK near 40°N, 51°W, and the highest wave was 43 ft reported by the SALLAND (35°N, 53°W). Several ships had 39-ft waves.

On the 8th the LOW had two centers, and the pressure had risen slightly to 970 mb. The CARCHESTER (40°N, 42°W) was trying to sail eastward with the storm. She was in a 60-kn wind band with 33-ft waves. The CLYDEBANK (37°N, 39°W) was sailing westward into 49-ft swells.

The original LOW disappeared as another formed about 300 mi to the south. This became the primary storm after fighting off the formation and invasion of several other LOWs.

At 0000 on the 9th the AMERICAN ARROW with a pressure of 970 mb was within 4 mb of the center of one of the sub-LOWs and had 70-kn winds from the

northeast. Winds of over 50 kn and waves of around 25 ft continued. The storm was moving into Europe on the 10th. The swell waves were still reaching 40 ft at times in the southwest quadrant of the storm, and this continued into the 11th. The storm was over the English Channel on the 12th with another rapidly approaching.

The ancestor of this storm crossed the Pacific Coast on the 7th. It weakened considerably as it crossed the western mountains, but then it was reconditioned in the Midwest storm factory with warm, moist air from the Gulf of Mexico. It crossed the Gulf Stream late on the 9th, where additional fuel was added. The northerly flow behind the storm brought extremely cold air over the East Coast. On the 10th the MIROSLAWIEC found 58-kn winds near 35°N, 66°W. By 0000 on the 11th the central pressure had plunged to 942 mb--48 mb in 12 hr. A ship on the east side of the storm had heavy rain, while one on the west side had heavy snow. A Japanese ship about 150 mi south of the center was fighting 60-kn winds and 39-ft swells. Five degrees latitude farther south the ZEALANDIC reported 33-ft waves.

Wind reports of 60 kn and waves up to 30 ft continued as the storm traveled eastward near 50°N. On the 12th the BOOKER VIKING was sailing with 60-kn winds and 49-ft waves in the vicinity of 43°N, 22°W, while the ATLANTIC PROSPER (48°N, 25°W) sailed westward almost across the storm's center with 46-ft waves. The BARWA (45°N, 22°W) measured 65-kn winds and 39-ft seas. The storm passed north of OWS Romeo, bouncing her with 30-ft waves.

On the 13th the storm moved into the English Channel. Another LOW had formed east of Belle Isle which

produced a long sausage-shaped area of low pressure from coast to coast between 50° and 55°N. North of 55°N the winds were easterly, and south of 50°N they were westerly with a long fetch. This produced high waves of 20 to 30 ft, especially south of 50°N. This circulation broke down on the 14th as new LOWs formed, changing the pattern and easing the weather over the sea lanes for a few hours.

This did not help northern Europe. The original LOW dissipated over Germany late on the 14th, and another which had formed off Cabo Finisterre moved inland. Blizzard conditions hit northern Europe on the 15th. Denmark and the Netherlands were especially hard hit. Four fishing trawlers sank from the heavy ice and seas, and the crewmen drowned. The 12,458-ton French FRANCOIS VIELJEUX sank near Vigo, Spain. The 41,964-ton Greek CHRISTINA II reported heavy-weather damage at Tenerife on the 18th while on a voyage from Libya. Storm-force winds kept the temperatures near minus 40°C at mid-day in Sweden and Denmark. At least 58 deaths were attributed to the cold. All transportation was at a standstill. In the south heavy rains caused floods and landslides in Italy. In Greek harbors the authorities banned all ships under 2,000 tons from sailing in the Aegean and Ionian Seas because of high winds. Heavy seas battered the Portuguese coast after the worst floods for more than a century. About 10,000 people were evacuated from flooded homes. Winds up to 90 kn hit the Oporto area, damaging the port terminal at Leixoes. An oil complex was damaged also as was the main hotel in the fishing village of Ericeira north of Lisbon. The storm finally moved over the Mediterranean Sea and relieved northern Europe.



Figure 27. --Traffic on inland waterways was severely hampered by ice. This tug was slowed as it delivered much needed oil. Wide World Photo.



Figure 28. --The barge CONTAINER TRANSPORT is high but not dry as she lies hard aground on the beach at Ocean View Beach, Va. The towing hawser snapped in severe weather. Wide World Photo.

This was one of the LOWs that helped to break down the long fetch and high waves of the storm above. It was first found on the 1800 analysis of the 14th south of Cape Race at 40°N. The BARWA immediately had 60-kn winds and 20-ft seas from the south as the gradient tightened between this LOW and the stationary Azores High. OWS Lima, still in the easterly flow, had 34-ft waves.

At 1200 on the 15th the 981-mb LOW was near 48°N, 40°W. The EXPORT FREEDOM at 38°N, 45°W had 33-ft swells from the southwest. The circulation was now circular. The LOW was traveling northward on the 15th and passed within a few miles of OWS Charlie. At 0000 of the 16th he measured 58-kn winds and 30-ft seas. Lima had 57 kn and 20 ft. By 1200 the 966-mb storm was near 60°N, 36°W. Both Charlie and Lima continued to measure 50- to 60-kn winds and 30- to 36-ft waves. The LOW crashed ashore on southern Greenland. At this time an immense 1050-mb HIGH centered over the Great Lakes dominated the United States, except for states along the Pacific coast. Record cold temperatures caused the Great Lakes to freeze over. Temperatures as low as minus 47°F were recorded in New York State. These same cold temperatures stemmed the flow of coal through Baltimore as it froze in the cars. Bulkcarriers were delayed as long as 3 weeks. Ice on the Chesapeake Bay ranged from 4 to 15 in with rafted ice as much as 6 ft (fig. 27). High winds are not usually associated with high pressure, but there are always exceptions.

This was one of them. The gradient east and south-east of the center was tight, and strong winds were blowing along the coast. The barge CONTAINER TRANSPORT (fig. 28) broke its hawser and was blown aground near Norfolk.

As the LOW described above died over Greenland, other LOWs were forming in the overall circulation. A small wave was moving northward up the cold front. The PIONEER COMMANDER was broadsided by 34-ft swells as she headed toward Fastnet Rock. On the 18th another LOW formed near the center of this immense cyclone near 54°N, 38°W. There was another small closed circulation at 40°N. The DYVI KATTEGAT, south of the storm near 50°N, 37°W, had 55-kn winds. Ocean Weather Station Charlie measured 50-kn winds and 25-ft seas. The LOW was analyzed as 958 mb, and Charlie registered 965 mb. Far to the south (34°N, 54°W) the BARWA reported 60-kn winds. On the 19th several ships, including the AMERICAN ARGOSY, had winds over 50 kn and seas of 30 ft. Ocean Weather Stations Charlie and Lima were still being bounced by waves over 20 ft. This storm also grounded on the Greenland shore.

Atlantic Monster of the Month--A frontal wave formed over the Gulf of Mexico on the 18th and crossed over Florida to the Gulf Stream. The large HIGH that was over the Great Lakes was moving off the coast near Cape Cod. This set up the ideal situation for a bliz-



zard on the U.S. East Coast. And this is just what happened. The LOW was diverted up and parallel to the coast, feeding moisture-laden air over a very cold surface layer. At 1200 on the 19th the 1004-mb LOW was off Norfolk, Va. A Navy ship (37°N, 74°W) reported 75-kn winds.

The snow began early on the 18th in Georgia and the Carolinas, and they received over 10 in. As the storm approached Washington, D.C., it was snowing up to 2 in/h in some places. Accumulations were as much as 2 ft along the seaboard. Washington National Airport had 18.7 in between 4:00 p.m. on the 18th and 11:00 a.m. of the 19th. It was the greatest snowfall in over 50 yr. There were 3- to 5-ft drifts in the metropolitan area, and the entire city was closed for the day. Six major airports on the East Coast were closed, while many others barely managed to keep one runway opera-

tional. Some of the major ports were closed or had only limited operations into midweek. Warm air from the Gulf behind this storm brought temperatures above freezing in the upper Midwest for the first time in as long as 60 days in some places.

Late on the 19th the storm turned eastward away from the coast. At 1200 the TEXAS TRADER was south of the center with 55-kn winds and 20-ft waves. At 1800 the EAGLE CHARGER had 64-kn winds and 20-ft waves west of the center, while the ATLANTIC CHAMPAGNE was north of the storm's center with 86-kn easterly winds. On the 20th two ships reported winds of over 60 kn in southerly flow with waves up to 33 ft. Another ship north of the center had 55-kn winds and 33-ft seas. The 21st was really a violent day. Five ships reported winds over 70 kn, one being preceded by STORM, so there were no call letters on the chart. The others were the ERIKA JACOB, ERLANGEN, and DON CARLOS. The SEA-LAND RESOURCE northwest of the center near 41°N, 47°W, had 70 kn, 25-ft seas, and 49-ft swells.

The storm turned northeastward on the 22d and 60-kn winds continued in all but the northeast quadrant. The STEPHANITOR (38°N, 41°W) about 400 mi south of the center had 49-ft waves. The 13,209-ton Greek STARLIGHT, bound Antwerp for New York, lost 20 40-ft containers overboard late on the 21st when stormy weather broke lashing materials. On the 23d another LOW was moving eastward south of this one and broke up the high wind and wave pattern in that area; but 60-kn winds and 26-ft waves were still occurring west of the center near 50°N. The ATLANTIC CAUSEWAY



Figure 29. --A wave jumps the sea wall at Hull, Mass., and strikes the second story of a house. Tides were 1.8 ft above normal. Wide World Photo.



(14,946 tons) lost two containers overboard during heavy rolling 750 mi east of Halifax, Nova Scotia. The storm passed slightly east of OWS Charlie on the 24th with 45-kn winds and 28-ft seas. Romeo had 33-ft waves. The storm was rapidly weakening and disappeared from the analysis late that day.

This storm was not noted so much for its high winds, but for its high waves, particularly swells reported by Ocean Weather Stations Charlie and Lima. On the 25th a LOW moved across the Labrador Sea. As the front crossed southern Greenland, a new LOW formed off the southeast coast on the 26th. At 1200 on the 27th the LOW was 978 mb over northwest Iceland. Lima reported 40-kn winds and 16-ft swells, while Charlie had 21-ft swells. Later, the swells picked up to 28 ft at Lima.

On the 28th Lima was reporting gales in the 40-kn range and waves to 25 ft. The SEA-LAND PRODUCER found 40-kn winds and 21-ft swells with a thunderstorm west of Bishop Rock. On the analysis of March 1, the storm had split into three centers with the original one turning northward over the Greenland Sea. Later, another moved south of Iceland.

This storm formed over the Gulf Coast late on the 24th. The OVERSEAS ALEUTIAN was south of Port Arthur sailing westward with 40-kn northwesterly gales on the 26th. The DELTA AMERICAN was off Cape Hatteras with 40-kn southerly gales. Both ships had 15-ft waves. Easterly winds north of the center resulted in high surf and tides along the New England coast (fig. 29). The LOW crossed the coast near New York early on the 27th. The SEA-LAND VENTURE was near 34°N, 66°W, slightly east of the front at 1200, with 45-kn gales and 23-ft waves. On the 28th the storm moved up the Bay of Fundy and on March 1 joined the larger circulation of the previous storm while over the Labrador Sea. By 1200 the LOW had raced to midway between Kap Farvel and Iceland at 974 mb. The CAPE ROGER (50°N, 50°W) found 42-

kn northwesterly gales and 18-ft waves. On the 2d the KAPITAN NOCHRIN (52°N, 44°W) had 50-kn winds on her port beam. A ship near 52°N, 20°W, was pounded by 25-ft waves. Charlie was tossed by 30-ft waves.

The 968-mb storm center was over Iceland at 1200 on the 3d. Lima was battling 58-kn winds and 33-ft waves. Others south of the storm had 25- to 30-ft waves. An English ship near 58°N, 11°W, had 70-kn winds with 43-ft waves, and a U.S.S.R. ship near 59°N, 02°E, had 85-kn winds and 25-ft waves. On the 0000 observation of the 4th a Norwegian ship reported 77-kn winds in the same area. By the 1200 chart, only a trough remained.

**Casualties**--The 647-ton Russian trawler METRO-STROY disappeared in the Barents Sea in a blizzard on the 4th. Two bodies were recovered from a life-raft with 37 others missing. The 4,208-ton Italian TORRES developed a list in gales off Ortona, Italy, while under tow. The towline was cast off and all trace of the vessel was lost. The 8,451-ton Greek IRIS sank on the 15th off Cabo de Sao Vicente after taking water during a storm. The 1,298-ton Panamanian COLON 1 ran aground during heavy weather on the 18th at Kara Burnu and washed up on the beach high and dry.

The bulkcarrier POLLUX, Liverpool for Jacksonville, arrived St. Michaels on the 17th with heavy-weather damage. The 3,052-ton Panamanian DOXA arrived Columbia with heavy-weather damage. The 3,094-ton French ferry SAINT GERMAIN and the 14,493-ton Liberian freighter ARTADI collided in the English Channel in heavy fog about 4 mi off the French coast. Two people were killed and four injured.

On the 23d there were 17 vessels waiting to enter the Port of Corpus Christi, Tex., because of heavy fog.

The 103,907-ton American tanker BROOKLYN was at Malta on the 25th with no engine power awaiting parts. Gale- to storm-force winds resulted in her dragging anchor.

## Smooth Log, North Pacific Weather January and February 1979

**S**MOOTH LOG, JANUARY 1979--Few storms penetrated the west coast of North America this month, as high pressure diverted them northward before they reached the coast. The primary track was generally eastward from Japan to midocean, where it abruptly turned northward into the Bering Sea. A second path was northeastward along the Kurile Islands. Late in the month a few storms entered the Gulf of Alaska, as high pressure over Alaska broke down. Frontal systems penetrated to the West Coast, but associated centers tended to dissipate over the water.

This month's mean sea-level pressure pattern over the North Pacific matched the climatic pattern much better than it did in the North Atlantic. The major feature was the 989-mb Aleutian Low at 54°N, 174°E, which was relatively close to its 999-mb climatic position of 50°N, 170°E. Another significant feature was a 1029-mb High centered over the Canadian Rocky Mountains.

There is normally a 1021-mb High in the area farther south near the Great Salt Lake. The high-pressure ridge over the southern part of this ocean was normal in location and pressure.

The prominent anomaly centers were associated with the pressure centers mentioned above. There was a minus 14-mb center near 60°N, 180°, and a plus 10-mb center near Edmonton, Canada. There was also a minus 9-mb center over the northwest shore of the Sea of Okhotsk.

In the upper air at 700 mb the low center was shifted eastward from the climatic position, resulting in a 103-mb anomaly over the central Bering Sea. The normal ridge over the North American west coast was shifted westward off the coast and sharper than usual. This resulted in positive anomalies over western Canada and Alaska.

There was one tropical cyclone over the western



ocean, typhoon Alice.

**Extratropical Cyclones**--High pressure moved over the Gulf of Alaska, Alaska, and western Canada on Christmas Day. This HIGH and ridge basically paralleled the coast and fluctuated in the area until January 10, when the cell over western Canada rapidly dropped southeastward. This block reached its maximum pressure of 1060 mb on the 3d. Lows over the central ocean moved against the HIGH and dissipated.

High pressure over the Gulf of Mexico that was centered over Texas produced Tehuantepecer winds over the Gulf. The AMERICAN ASTRONAUT found 60-kn winds and 20-ft waves.

This LOW formed as a frontal wave on the 3d on a front that developed from a trough over midocean. It was 988 mb near 37°N, 178°W, at 1200 on the 3d. By 0000 on the 4th it was 966 mb near 41°N, 170°W. This was a fall of almost 2 mb per hr. The OCEAN DUKE with a pressure of 969.5 mb was very near the center with 50-kn winds and 28-ft seas. Other ships were receiving gales in the 40-kn range. The storm slowly drifted northward and at 1200 on the 5th was 980 mb near 50°N, 170°W. The ALASKA STANDARD was south of Shelikof Strait with 40-kn northeasterly winds and 36-ft swells. A LOW had formed off the California coast, but it only survived about 36 hr. On the 6th the LEO (46°N, 177°W) reported winds of 64 kn. The LOW was drifting southeastward on the 6th and was absorbed by an approaching LOW on the 7th.

This storm penetrated a little farther into the HIGH than the previous one, but it had a longer run at it. At 0000 on the 6th the 998-mb circulation was near 35°N, 165°E. The SANTA BARBARA MARU (38°N, 161°E) discovered 57-kn northerly winds. By 1200 on the 7th the ALASKA STANDARD was near Montague Island with 78-kn southeasterly winds. This LOW absorbed the previous LOW and was a large circulation. The NANCY LYKES was about 750 mi south of the center and measured 55-kn winds and 20-ft seas. On the 9th the storm was 958 mb near 44°N, 153°W. This was as far east as the low center penetrated. The CHESTNUT HILL (45°N, 145°W) encountered 45-kn winds and 20-ft waves. OWS Papa also measured 45-kn southeasterly winds with 25-ft waves. On the 10th the PHILADELPHIA (56°N, 141°W) was sailing into relatively mild 40-kn winds, but her swell waves were 30 ft. North of the Aleutians near the date line the KASHIMA MARU had 56-kn winds from the north. On the 11th the storm was deteriorating rapidly. It dissipated on the 12th.

A large 1058-mb cold HIGH was centered near Lake Baykal on the 10th. It was pouring extremely cold air--as low as -50°C--into Manchuria. A front lay east-west across Korea and Japan, and a wave formed over the Sea of Japan. The storm raced northeastward under strong flow aloft. By 0000 of the 11th it was 968 mb near 48°N, 159°E. A SHIP near the center with 974-mb pressure had 65-kn winds and 21-ft seas. The QUEENS WAY BRIDGE (48°N, 160°E) and the WORLD SUPREME (40°N, 148°E) both found 30-ft seas. The PACIFIC VENTURE at 41°N, 179°E, felt the sting of the storm with 30-ft waves.

By 0000 on the 12th, the storm was 952 mb at 55°N, 167°E. It was generating some very severe

weather. Two ships were especially hard hit. The HARFLEUR (53°N, 169°E) (959 mb) was ravaged by 71-kn southwesterly winds, 46-ft seas, and 54-ft swells; and not far away the D5GO (51°N, 169°E) (977 mb) had to stay afloat in 57-kn winds, 33-ft seas, and 39-ft swells.

The HARFLEUR was moving eastward while the storm was traveling northward, but she still had 43-ft waves and winds of 50 kn. The ASIA HUNTER was west of Umnak Island with 50-kn southerly winds. Early on the 14th a ship near 49°N, 166°E, had 30-ft swells. A frontal wave was moving northeastward around the storm's outer circulation and weakening the gradient around the original storm, but the PRESIDENT JEFFERSON ran into 60-kn winds and 30-ft seas with the wave.

This surface LOW formed in response to an already-formed upper air LOW near 42°N, 160°W, on the 11th. It moved northeastward and at 0000 on the 13th was 990 mb near 47°N, 147°W. A ship near 42°N, 142°W, had 31-ft swell waves. Late on the 13th a second center formed southeast of this one. Another ship near 38°N, 139°W, had 52-kn winds and 33-ft waves on the 14th. Later in the day the second LOW absorbed the first and was 980 mb near 44°N, 131°W. What was probably the same ship had 65-kn winds and 34-ft waves at 1200. The AUSTRAL MOON at 43°N, 125°W, measured only 35-kn winds, but they were producing 17-ft waves with 33-ft swells.

This storm was making a brave attempt to break through the ridge and penetrate the California coast. The LOW covered the shipping lanes from California to Hawaii, and several ships recorded winds over 40 kn. In the southwest quadrant the ROBERTS BANK (34°N, 137°W) and the WESTOCEAN (36°N, 141°W) had 50-kn winds with 26- and 31-ft waves, respectively. The center pushed almost to the northern California coast, but it had split into two weak centers on the analysis of the 16th.

For many days there had been a quasi-permanent LOW east of the Kamchatka peninsula. Several LOWs had rotated around the periphery toward the Bering Sea. Fort Randall measured 50-kn winds on the 15th with the passage of one of these storms. The VAN WARRIOR to the south had 55-kn winds, 25-ft seas, and 41-ft swells. About this time a frontal wave developed east of Tokyo. It raced eastward at over 50 kn producing gales. On the 16th it moved deeper into the parent circulation of the LOW over the Bering Strait. As it entered the Gulf of Alaska on the 17th, it started to deepen and was 972 mb near 55°N, 148°W, at 0000 on the 18th. Three ships reported swell waves from 36 to 41 ft. They were the OJI GLORIA (53°N, 143°W), the VAN ENTERPRISE (46°N, 142°W), and a SHIP (53°N, 137°W). The CHEVRON OREGON and VAN ENTERPRISE both reported 74-kn winds. On the 19th two ships had 26-ft swell waves near 53°N and south of the storm's center. The storm moved ashore at midday and disappeared.

This LOW almost exploded into a full-blown storm. Within 18 hr after it was first analyzed it was sporting 60-kn winds 400 mi south of the center. The VAN-GUARD measured 54-kn winds and 33-ft waves near 39°N, 160°E. At 1200 on the 18th the LOW was 981 mb near 38°N, 147°E. An English ship 200 mi from the center had 26-ft waves. Gales were blowing in

all quadrants on the 19th. The CHIKUZEN MARU at 39°N, 156°E, reported westerly winds of 70 kn, and two ships had 33-ft waves. By 0000 on the 20th the storm was 952 mb near 50°N, 170°E. The SANKO-GRAIN had 60-kn winds southwest of the center. The EURYALUS (47°N, 159°W) suffered 46-ft waves with 55-kn winds. The islands of Saint Paul, Adak, and Unimak all measured at least 40-kn winds.

The storm reached its lowest pressure of 944 mb on the 21st. It appeared that the storm had chased many ships either into port or to the south as reports were few even at 0000. The highest wind reported was 50 kn on the edge of the storm. With the tight gradient there should be stronger winds closer to the center. By the 22d the storm was filling, but the VAN ENTERPRISE (45°N, 167°W) had 65-kn winds and 30-ft waves. The EXXON SAN FRANCISCO (60°N, 146°W) was in 50-kn winds and 31-ft seas. The storm moved slowly through the Bering Strait and disappeared on the 25th.

This LOW came out of the same area as the previous one but was a slow learner. It moved eastward across the Tuguru Strait. Two ships found high swell waves, which were probably associated with the previous storm. The ZENLIN GLORY near 36°N, 160°E, found 30-ft waves south of the LOW, where the winds had not changed their westerly orientation from the previous storm. The LOW was centered near 46°N, 176°E, at 994 mb at 0000 of the 23d. The VAN ENTERPRISE measured 34-ft swells with 43-kn winds about 550 mi southeast of the storm's center. At 1200 the PRESIDENT MADISON (45°N, 175°W) had 40-kn gales. On the 24th the VAN ENTERPRISE had sailed about 150 mi in 24 hr. Her winds were now 47 kn and the swells 36 ft. At 1200 the SEA-LAND TRADE (47°N, 159°W) was sailing with 31-ft swells. On the 26th the weakening storm passed south of Kodiak Island and then inland.

On the 24th the ocean north of latitude 25°N was cut up by eight low centers and three high centers of various sizes. On the 0000 chart of the 25th a low-pressure center was analyzed on a cold front near 34°N, 173°E, with the aid of observations from the IRIS ISLAND and 9VUP. West of the LOW, but only connected to it by the general circulation, the BENNY SKOU was caught by 34-ft swells.

The frontal wave rolled northward up the front and absorbed three small low centers and one high center. The tightly wound storm was 961 mb near 45°N, 178°W, at 0000 on the 26th. The MUSA was within a few miles of the center with a barometric pressure of 966 mb, 40-kn southerly winds, and easterly 30-ft swells. An unidentified ship 240 mi to the southeast was sailing with 30-ft swells from the south-southwest. The SHUKO MARU took the award though with 49-ft swells from the northeast while about 700 mi northwest of the storm. At 0600 two ships reported 60-kn winds with one having 30-ft seas. By 1200 the storm had consumed another small center.

The BENNY SKOU was sailing eastward as the storm moved northward, but this did not prevent her having 34-ft swells on the 27th. Two other ships in the southeast quadrant had 30-ft swells. By midday on the 28th the storm was gone.

As usual, this storm was born as a frontal wave. This

time northeast of Tokyo on the 25th. It moved eastward as the last storm moved northward. By 0000 on the 27th the LOW was 982 mb near 35°N, 162°E. The LOW had crossed slightly north of the westerly track of the KOREAN PRIDE. At this time she had 50-kn winds from the northwest, 26-ft seas, and 30-ft swells. The SEA-LAND COMMERCE must have been within a few millibars of the center as at 0600 she was due west of the center with 80-kn northerly winds, 33-ft seas, and 41-ft swells. At least three other ships reported waves to 25 ft.

High pressure was protecting the U.S. West Coast by diverting the storms northward as they approached 180°. That is what happened to this one on the 28th. On the 29th it turned westward and on the 30th swallowed another LOW that was following it. At 1200 the large storm was only 993 mb near 53°N, 172°E, with a loose gradient and light winds. A ship far to the south near 32°N had 26-ft swell waves. The storm was assimilated into another that formed on the associated front on the 31st.

This was a vicious, short-lived small storm that seemed to appear out of nowhere and disappeared in the same way. It was the one the previous storm absorbed on the 30th. A 10-kn easterly wind report of the VAN ENTERPRISE at 0000 on the 28th was the tip off that this LOW had formed. Twelve hours later she measured 67-kn winds. The STREAM DOLPHIN (29°N, 163°E) was pounding into 29-ft swells from the northwest on her westerly course. Another hint of the storm was the increased winds south and west of the center. The PRESIDENT JEFFERSON (44°N, 152°E) found 70 kn, 33-ft seas, and 41-ft swells northwest of the storm at 0600; by 1200 the LOW was 976 mb. The LIONS GATE BRIDGE (40°N, 164°E) was about 1° latitude to the south of the center with 65-kn winds. The SILVER-MAIN 400 mi to the south was sailing into 55-kn westerly winds and 26-ft waves. On the 29th two ships radioed winds of 50 kn. The PRESIDENT VAN BUREN was far south (30°N, 163°E) with 33-ft swell waves from the west. At 0600 the PRESIDENT JOHNSON was nearly overwhelmed by 56-kn southwesterly winds, 30-ft seas, and 46-ft swells. On the 30th the storm moved close to the previously described storm and was absorbed.

The Pacific High was firmly entrenched in the vicinity of 40°N, 150°W, on the 31st. In the previous days, several fronts had piled up on its west side and dissipated. On the 30th another paralleled 170°W, and on the 31st a wave formed near 40°N, 173°W. At 1200 the HIEI MARU (40°N, 171°W) measured 50-kn winds. By February 1 it had absorbed an older LOW to the northwest and was 982 mb near 47°N, 170°W. The VIOLET (46°N, 165°W) had 48-kn winds. A ship on the opposite side of the LOW (173°W) had 40-kn winds and 20-ft seas. On the 2d the storm crossed into the Bering Sea near Atka Island. The CANADA MARU and TAIKAI MARU were near 53°N, 179°W, with winds of plus 40 kn, but their real problem was 33-ft swells. At 0600 the PRESIDENT MADISON was in the same vicinity with 26-ft waves. On the 3d the storm stalled near 50°N, 165°W, and no longer existed on the 4th.

A wave formed on a front that finally managed to penetrate the northern part of the Pacific High on the 29th

off Seattle. It moved southward with little affect on shipping along the coast. There were several isolated reports of 40-kn gales. It was on the 31st in the Los Angeles area that the LOW made its reputation. On the night of the 30th it drenched Long Beach with nearly 4 in of rain. Before it was over Los Angeles had almost 5 in. On the 31st thunderstorms were occurring along the coast and 1.5 in of hail fell south of Los Angeles at Torrance. A waterspout was sighted west of Los Angeles airport. A possible tornado caused millions of dollars damage to Universal Studios. In higher elevations there was heavy snow. On February 1 the storm moved inland and dissipated.

**Tropical Cyclones**--January tropical cyclones occur about once every 2 yr. Typhoons are even less common, and one of Alice's intensity is rare. They are usually low-latitude storms, and Alice conformed to this rule. She developed nearly 300 mi south of Kwajalein on New Year's Day. After moving northward for a few days, she turned westward near Kwajalein. Alice reached typhoon strength on the 6th shortly after passing Entwetok. On the 7th winds near her center were roaring at 100 kn, an intensity she maintained until the 9th. Alice was a compact typhoon, and her strong winds were confined to within about 15 mi of her center. Peak winds were estimated at about 110 kn with gusts to 135 kn on the 8th. Alice passed about 100 mi south of Guam on the 9th. Two days later she slowed and began to recurve northward. By the 12th she started to undergo severe vertical wind shear. This process caused her to weaken rapidly. Winds dropped to tropical-storm strength the following day. By the 14th Alice was a weak depression southeast of Iwo Jima.

**Casualties**--The 26,024-ton Israeli ZIM HAIFA was in Hong Kong on the 4th with heavy-weather damage. The Panamanian bulkcarrier BEACONS (16,466 tons) was at Kawasaki on the 5th with heavy-weather damage to bulwarks and deck stanchions. The 700-ton ferry SHODOSHIMA MARU and the 196-ton freighter KYOEI MARU collided in fog on the Inland Sea on the 9th.

The U.S. deck barge ANTONE F. was reported in danger of sinking on the 8th about 150 mi southwest of Coos Bay, Oreg., after a cargo of grain shifted in heavy weather and the stern ballast tanks flooded. The 12,174-ton PAC MAJESTY encountered heavy weather enroute from the United States to Tomakomal. The No. 1 hold was flooded, and hatch pontoons were carried overboard.

The Liberian 10,239-ton MIDAS PRINCE, Vancouver to Kobe, with a cargo of grain encountered heavy weather and took shelter near Agattu Island on the 13th. On the 19th the 10,019-ton SEALANE TRADER, Vancouver to Kobe, reported heavy-weather damage sustained during December and January. The 12,187-ton ASIAN HAWK on a voyage from Port Angeles to Tokyo encountered heavy weather and diverted to Honolulu. They lost 70 logs and 4 hatch pontoons and received hull damage.

The 39,503-ton Liberian UNIVERSE CONVEYOR was due Kobe on the 21st with heavy-weather damage. The American 9,110-ton JOHN TYLER sailing for Nakhodka, Russia, reported on the 24th that 13 tractors broke loose from their lashings during heavy weather.

**SMOOTH LOG, FEBRUARY 1979**--The primary climatological areas for cyclogenesis are east of Japan and midway between Hawaii and Vancouver Island. This month these areas were shifted slightly westward. The primary storm tracks were also shifted to the west. One primary track extended from Japan up the Kurile Islands in the Bering Sea. There was a secondary track from off Japan into the eastern Bering Sea. Most storms that entered the Gulf of Alaska came out of the central ocean north of Hawaii. These were blocked by the anomalous high pressure over Alaska and turned southeastward or dissipated. One vicious storm hit the U.S. West Coast, and high pressure over Alaska in conjunction with several LOWs produced high winds along the south coast of Alaska.

The mean sea-level pressure was near or above normal over most of this ocean except for an area off the North American coast between northern California and southeastern Alaska. The mean sea-level pressure pattern for the month shows two LOWs, a 1002 mb over the Gulf of Alaska and a 1004 mb near the Near Islands. The Pacific High was centered near 30°N, 138°W, at 1024 mb. There was the usual small HIGH near the Great Salt Lake. Of more significance, though, were two high-pressure centers along the Arctic Circle. This is normally an area of high pressure, but this month it was much stronger. There was a 1034-mb HIGH near the Great Bear Lake of northern Canada. There was also a 1026-mb HIGH over northern Siberia.

The anomaly chart showed an elongated positive anomaly center of 16 mb across northern Alaska to the Great Slave Lake. There was a large area of positive anomaly values, with a plus 10-mb center, centered over the northern ocean. The only significant negative anomaly area was off the Queen Charlotte Islands with a 7-mb center.

The upper air flow was quite different from the climatic pattern. Climatology shows a closed LOW over Kamchatka with a ridge off the North American west coast. Between 30° and 50°N the flow is primarily zonal. This month the long-wave LOW was south of the Taymyr peninsula at 70°N. A trough curved southeastward then eastward from the LOW to near Beringa Island. Another LOW was near Yakutat, Alaska. Between the trough and the LOW an inverted teardrop-shaped HIGH was over the Bering Strait. There was slight ridging over the Rocky Mountains. As at the surface, the height anomalies were mainly positive except off the coast of British Columbia.

**Extratropical Cyclones**--The first storm of the month only affected the Asian side of the ocean. It was over the Sea of Japan on the 1st. Ostrov Urup measured 45 kn at their station. The KOMITCHESKI was near Ostrov Simushir with 54-kn winds. The 992-mb storm was tracking northeastward inside the Kurile Islands on the 2d. That day and the 3d Soviet vessels were reporting gales in the 40-kn range with an occasional 50-kn report. The AMSTELVELD found 40-kn gales and 20-ft seas near 47°N, 160°E. The PRESIDENT MADISON was near 50°N, 166°E, with 55-kn winds and 25-ft seas. Six hours later on the 4th she had traveled about 50 mi toward the west-southwest into 50-kn winds and 30-ft swells. On the 4th the storm crossed into the Bering Sea and dissipated on the 5th.





**Pacific Monster of the Month**--On the 3d there was a weak LOW over the Gulf of Alaska between two intense high-pressure cells. One HIGH was 1044 mb over northern Alaska, and the other was the 1038-mb Pacific High off California. On the 4th the first LOW dissipated and another formed near Kodiak Island. The Alaska High moved over the Northwest Territories by the 5th and the LOW blossomed. At 0000 it was 972 mb. At 1800 on the 4th a SHIP (53°N, 133°W) had 58-kn winds from the south. On the 5th the AMERICA SUN (51°N, 136°W) and the RAINIER (53°N, 134°W) both had 48-kn winds. Reports received by Peggy Dyson of WBH-29, Kodiak, indicated even higher winds, especially gusts. The PACIFIC VENTURE near Cape Pankof (Unimak Island) reported winds of 50 to 65 kn with gusts up to 75 kn. The JUSTINE FOSS was about 5° longitude to the east with northwesterlies of 35 kn gusting to 60 kn. The COMMANDER was west of Cape St. Elias (Kayak Island) proceeding to Seward with 50- to 60-kn winds gusting to 70 and 15- to 20-ft swells.

The pressure gradient across southern Alaska was extremely tight. The 4-mb analysis was almost a solid block rather than individual lines. The winds south of the storm were in the 40-kn range with waves up to 20 ft. On the 6th two ships had 25-ft waves on the Gulf. The LOW remained nearly stationary and filled slightly, but the gradient remained tight over the coast.

On the 5th the winds at Valdez were up to 45 mi/h with gusts to 59 mi/h. On the 6th they gusted to 73 mi/h, and gusts of over 50 mi/h continued through the 10th. The average speed was over 20 mi/h. At Anchorage the strongest sustained wind was 41 mi/h on the 7th, with the strongest gust of 62 mi/h reported on the 8th. Flow of oil in the Alaska pipeline was stopped and no tankers were loaded between the 5th and the 9th. On the 12th there were nine tankers waiting entrance to the terminal. Also, ice was building rapidly in Cook Inlet. On the 7th and 8th the ALEUT PACKER south of Kodiak Island and the OCEAN BOUNTY off Port Graham had winds of 50 to 60 kn (gusting to 90 kn according to the OCEAN BOUNTY) with waves of 12 to 30 ft. The winds picked up again on the 14th and 15th. Anchorage had sustained winds of over 50 mi/h with gusts to 64 mi/h on the 14th and Valdez had a 25 mi/h average with gusts to 79 mi/h. On the 15th the gusts were 48 and 62 mi/h, respectively.

This was one continuous storm but not one LOW. The Pacific High vacillated around its position off California and Arctic Highs moved across the north coast of Alaska. The original LOW dissipated on the 7th as another

formed off Kodiak and drifted across the Gulf at an average pressure of about 998 mb until the 12th. At this time a strong LOW was moving toward Vancouver Island from its origin near Hawaii. This one moved inland on the 13th. This individual storm is described later. Another LOW developed over the Alaska Peninsula at this time. During this time a HIGH that was up to 1049 mb was crossing the Arctic Coastal Plain of northern Alaska. The gradient along the southern coast remained tight. It was while this last LOW moved southeastward across the Gulf that the high winds had occurred on the 14th and 15th.

Back to the effect of all this on ships. On the 8th a ship south of Kodiak fought 45-kn winds and 30-ft seas. On the 10th the HAKUZAN MARU reported 67-kn southeasterly winds off northern Vancouver Island. On the 14th the ASIA ZEBRA reported 54-kn winds near 54°N, 154°W. On the 15th the U.S. ships MILLER FREEMAN and MOBIL ARCTIC were northwest and north of the center with 41- and 48-kn winds, respectively. At 1800 the ARCO JUNEAU and the PRINCE WILLIAM SOUND were within 30 mi of each other near 56°N, 151°W. Both had 60-kn winds and the later 30-ft seas. Some ships far to the south (latitude 35°N) were finding 40-kn gales and 20-ft waves. During the 13th to 15th several fishing vessels reported 45- to 60-kn winds with waves as high as 20 ft. These observations were generally north and south of Kodiak Island. On the 13th buoy 46002 measured 55-kn winds and 31-ft seas. Between the 12th and the 16th the OVERSEAS WASHINGTON was sailing northwestward up the coast toward Alaska. She reported waves up to 49 ft on the 13th off Portland and winds as high as 70 kn on the 15th off Sitka. Late on the 17th the last LOW disappeared as another approached the British Columbia coast.

This was the LOW mentioned above that originated north of Hawaii. It was first analyzed as a frontal wave on the 11th. The storm steadily intensified as it moved northeastward. At 1200 on the 12th it was 978 mb near 40°N, 137°W. At that time a SHIP had 45-kn winds and 20-ft seas about 300 mi to the southwest. Twelve hours later at 0000 on the 13th the storm was 968 mb near 45°N, 132°W. There were several ships around the storm with high winds and seas. They included: ship - 70 kn, buoy 46002 - 50 kn and 31 ft, SHIP - 36 ft, ARCO JUNEAU - 65 kn and 23 ft, SHIP - 55 kn, 30 ft, and 49 ft.

At 1200 on the 13th the LOW went ashore at Hecate Strait. Winds up to 50 kn and waves to 30 ft were being reported. Four men were washed off the deck of the 15,067-ton WISTARIA CORAL and a fifth was hurled against a bulkhead and killed off Coos Bay, Oreg. The Hood Canal Floating Bridge at Port Gamble, Wash., had the west section of the bridge washed away (fig. 30) in winds that reportedly reached 100 mi/h. No one was on the bridge at the time. Thousands were without power and two deaths were associated with the storm. Winds and gusts of 50 to 60 mi/h were measured from California to Washington. Cape Flattery recorded gusts to 85 kn. On the 14th the mountains destroyed the storm.

During the first 2 weeks the ocean was occupied by many relatively small storms with winds in the gale category. This storm formed at the occlusion of the



Figure 30.--A Coast Guard cutter sails across the area where the west end of the Hood Canal Floating Bridge was swept away by a violent windstorm. Wide World Photo.

front extending from one of these near  $45^{\circ}\text{N}$ ,  $169^{\circ}\text{W}$ , on the 15th. The LOW moved eastward pulling its circulation from the last storm over the Gulf of Alaska. At 0000 on the 17th the 988-mb LOW was near  $46^{\circ}\text{N}$ ,  $144^{\circ}\text{W}$ . A SHIP ( $42^{\circ}\text{N}$ ,  $147^{\circ}\text{W}$ ) had 54-kn winds and 33-ft swells. Later another had 50 kn and 28-ft swell waves. Late on the 18th the storm bounced off the coast to disappear over the Gulf of Alaska on the 19th.

The Japan Trench off Tokyo was the origin of this LOW on the 15th. It moved northeastward and was 980 mb with 40-kn winds at 0000 on the 16th. Two synoptic charts later showed it was 972 mb along the Kurile Islands. The POUTIVL ( $42^{\circ}\text{N}$ ,  $157^{\circ}\text{E}$ ) radioed 50-kn winds and 18-ft waves. The EDELWEISS reported at 0000 on the 17th with 60-kn winds and 49-ft seas near  $48^{\circ}\text{N}$ ,  $160^{\circ}\text{E}$ . The temperature was below freezing. The PRESIDENT PIERCE ( $51^{\circ}\text{N}$ ,  $159^{\circ}\text{E}$ ) found 45-kn winds and 25-ft waves. Other ships were reporting 33-ft waves. The storm turned northward and moved over Siberia.

This LOW tracked out of China and crossed Japan on the 17th. The PRESIDENT MADISON south of Kyushu measured 50-kn winds and 21-ft seas after frontal passage. On the 18th there were six U.S.-recruited ships in the vicinity of this storm that mailed in reports of winds over 40 kn. The SEA-LAND FINANCE ( $36^{\circ}\text{N}$ ,  $148^{\circ}\text{E}$ ) rang the bell with winds of 48 kn and 30-ft swell waves. At 0000 on the 19th the 972-mb LOW

was near  $46^{\circ}\text{N}$ ,  $166^{\circ}\text{E}$ . The SEA-LAND MCLEAN  $5^{\circ}$  latitude to the south was in contact with 45-kn winds and 25-ft waves. The storm crossed the Aleutians late on the 19th. On the 20th a U.S. ship near Kiska Island had 40-kn winds and 19-ft seas. The storm disappeared on the 21st.

This storm formed off Hokkaido on the 19th and initially tracked eastward. The STAR BULFORD was headed southwestward with 50-kn northwest winds and 16-ft waves pounding her beam on the 19th and 20th. Other ships east of the front found 20-ft waves. The KATORI MARU was in the vicinity of  $42^{\circ}\text{N}$ ,  $159^{\circ}\text{E}$ , with 55-kn winds and 33-ft swells for two observations. On the 21st a Japanese ship JRZI had 50-kn winds and 39-ft swell waves near  $34^{\circ}\text{N}$ ,  $167^{\circ}\text{E}$ . Another ship near  $37^{\circ}\text{N}$ ,  $172^{\circ}\text{E}$ , had 25-ft seas and 33-ft swells. The LOW was 976 mb near  $48^{\circ}\text{N}$ ,  $175^{\circ}\text{E}$ . By the 22d the LOW was filling rapidly and turning northwestward.

This storm tracked across northern China and crossed into the Sea of Okhotsk on the 21st. On the 22d it hit a group of Soviet ships among the Kurile's with winds up to 56 kn. One of the islands measured 45-kn winds, and a ship along  $40^{\circ}\text{N}$  had 26-ft waves. The SEA FAN ( $50^{\circ}\text{N}$ ,  $160^{\circ}\text{E}$ ) measured 47-kn winds from the south and 18-ft seas. At 1200 on the 23d the storm was 975 mb near  $52^{\circ}\text{N}$ ,  $168^{\circ}\text{E}$ . South of the center the SUCCESSFUL VENTURE ( $49^{\circ}\text{N}$ ,  $170^{\circ}\text{E}$ ) had 50-kn winds and 23-ft waves. Much farther south the SHUKO MARU ( $43^{\circ}\text{N}$ ,  $160^{\circ}\text{E}$ ) had 33-ft swell waves.

Continued on page 275.



# Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

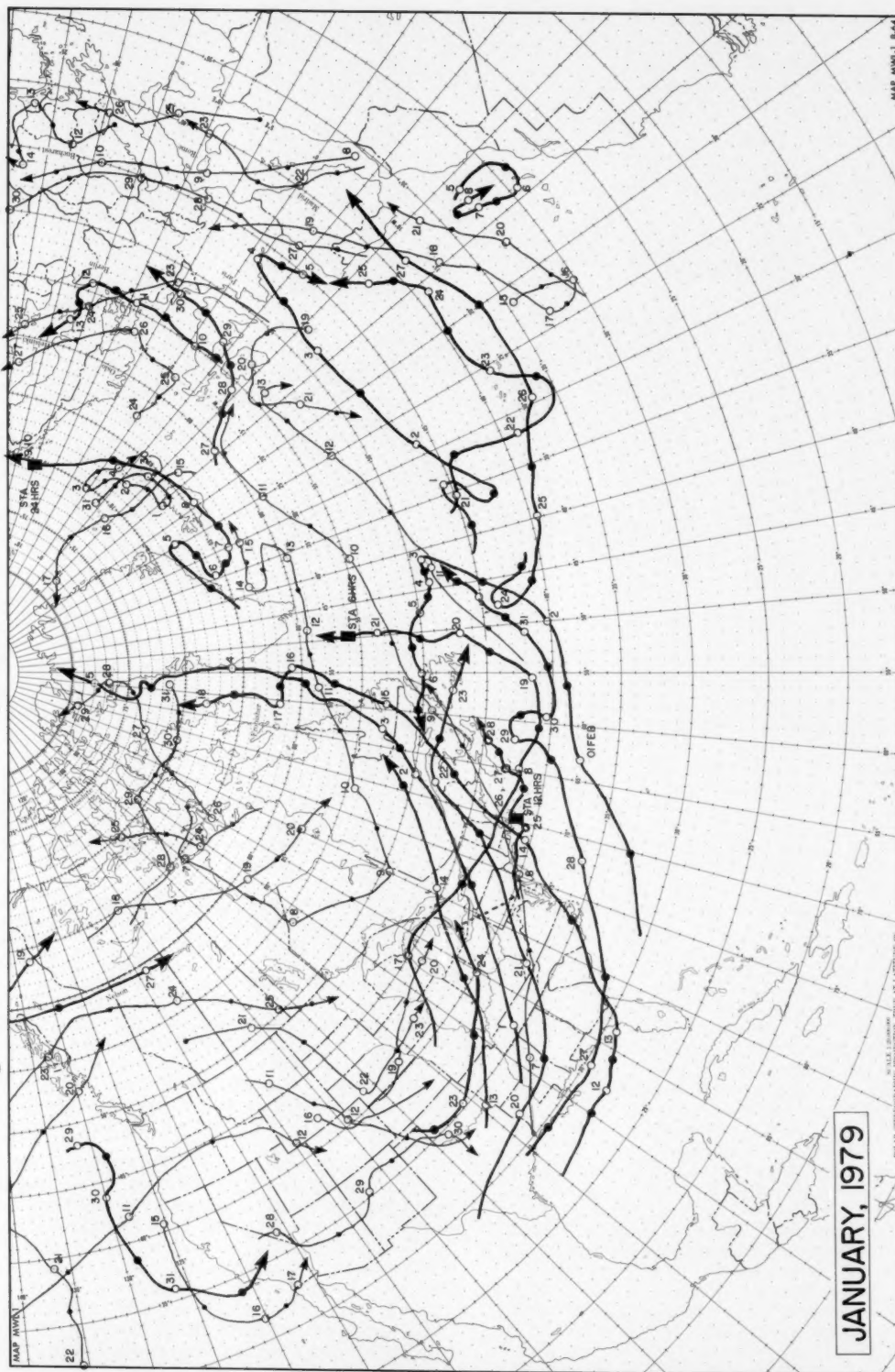


Figure 31. -- Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

# Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

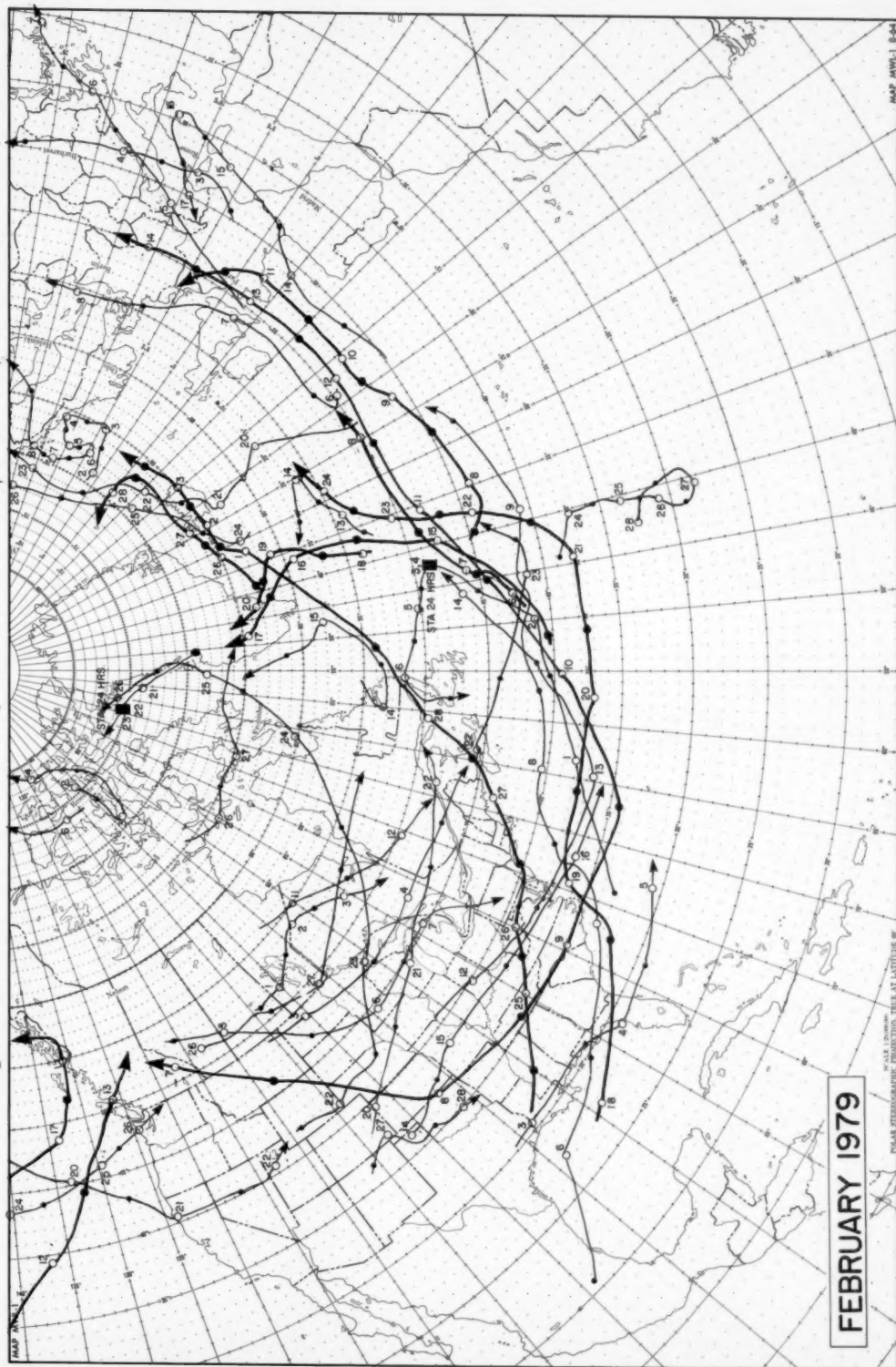


Figure 32. -- Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

# Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

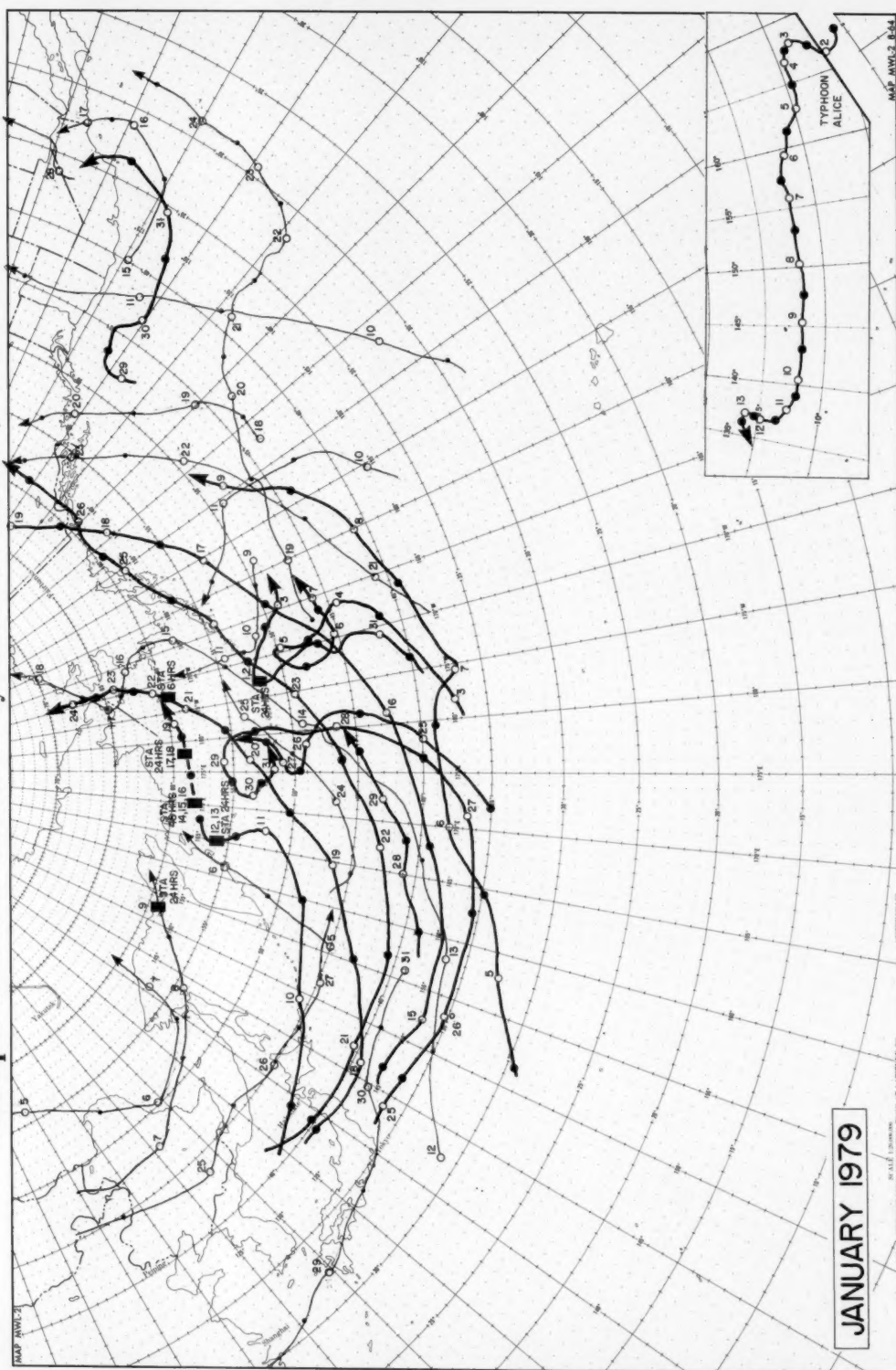


Figure 33. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

# Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

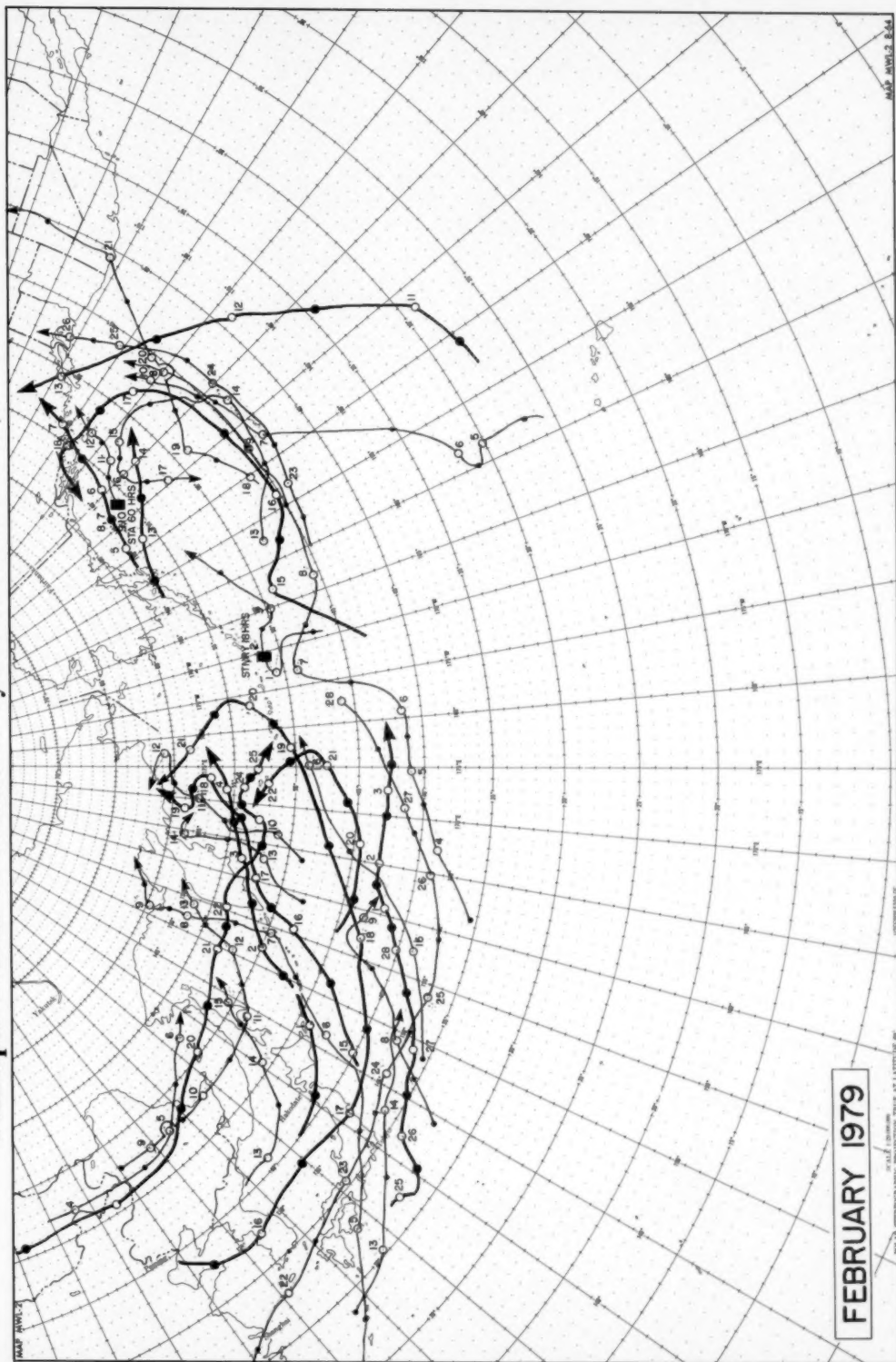


Figure 34. -- Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.



# Table 14

## U.S. Ocean Buoy Climatological Data

### January and February 1979

JANUARY										DATA SUMMARY										WIND																																																	
AVERAGE LATITUDE 32.3N										AVERAGE LONGITUDE 079.3W																																																											
MEANS AND EXTREMES																																																																					
										MIN (DA HB)										MEAN (DA HB)										NO. OF DAYS WITH																																							
AIR TEMP (DEG C)										10.7										15.0										22.0										(21 12)										98										1									
SEA TEMP (DEG C)										20.0										20.5										21.0										(21 01)										98										1									
AIR-SEA TEMP (DEG C)										10.7										0.5										1.0										(21 01)										98										1									
PRESSURE (MMHG)										1004.7										1007.3										1009.0										(20 00)										98										1									
WIND - N FREQUENCIES, MEANS AND EXTREMES																																																																					
										SPEED (KNOTS)										TOTAL SPEED										NO. OF DAYS WITH																																							
										4 11 22 34										4 11 22 34										4 11 22 34																																							
DIR										4 10 21 33 47										147										1																																							
N										2 1										2 1										4 6																																							
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NW										1										1										1																																							
CALM										1										1										1																																							
TOTAL										2 12 44 30 6.3										1.0										100.0 19.8																																							

FEBRUARY										DATA SUMMARY										41002									
AVERAGE LATITUDE 32.3N										AVERAGE LONGITUDE 079.3W																			
MEANS AND EXTREMES																													
										HIT										(DA HB)									
AIR TEMP (DEG C)										07.9										(10 00)									
SEA TEMP (DEG C)										20.0										(20 00)									
AIR-SEA TEMP (DEG C)										12.1										(10 00)									
PRESSURE (MMHG)										1001.3										(10 00)									
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										1001.3										(10 00)									

JANUARY										SUMMARY										4100A																			
AVERAGE LATITUDE 32.8N										AVERAGE LONGITUDE 078.7W																													
MEANS AND EXTREMES																																							
										I										I																			
AIR TEMP (DEG C)										10.0 (10 15)										12.0 (20 15)										24.7 (31 21)									
SEA TEMP (DEG C)										20.0 (20 00)										20.5 (21 00)										20.7 (21 00)									
AIR-SEA TEMP (DEG C)										-10.0 (10 15)										0.4 (21 00)										2.7 (31 21)									
PRESSURE (MMHG)										1004.7 (121 00)										1007.3 (10 15)										1009.0 (21 00)									
WIND - N FREQUENCIES, MEANS AND EXTREMES																																							
										SPEED (KNOTS)										MEAN																			
										4 11 22 34										TOTAL SPEED																			
DIR										4 10 21 33 47 147										NO. OF DAYS WITH 247																			
N										1 2 8 9 4 6										15.0 10.3																			
NE										1 1 2 9 3 7 8										13.0 8.1 11.4																			
E										1 2 2 5 1 6										8.0 7.0 8.7																			
SE										1 4 2 0 2 0										4.0 6.0 8.2																			
S										1 4 1 1 3 2 2										13.0 8.1 11.4																			
SW										1 1 2 3 2 0										9.0 8.0 17.3																			
W										1 5 6 1 0 1 7 7										17.0 17.0 17.0																			
NW										4 4 5 5 1 5 4										19.0 8.1 14.7																			
CALM										1										1																			
TOTAL										7 3 20 1 40 2 1 6										100.0 19.8 14.0																			

FEBRUARY		SUMMARY										41004	
AVERAGE LATITUDE 32.8N					AVERAGE LONGITUDE 079.7W								
MEANS AND EXTREMES													
		MIN	(DA HB)	MEAN	MAX	(DA HB)	NO. OF DAYS WITH						
AIR TEMP (DEG C)		10.3	(10 12)	11.7	22.5	(23 15)	224	1		28			
SEA TEMP (DEG C)		10.3	(10 12)	10.6	21.3	(23 15)	224	1		28			
AIR-SEA TEMP (DEG C)		0.0	(10 12)	1.1	10.9	(23 15)	224	1		28			
PRESSURE (MMHG)		1002.0	(20 00)	1021.1	1033.0	(20 15)	224	1		28			
WIND - N FREQUENCIES, MEANS AND EXTREMES													
		SPEED (KNOTS)				TOTAL SPEED				NO. OF DAYS WITH			
		4	11	22	34	4	11	22	34				
DIR		4	10	21	33	47	147	1		224			
N		1	2	1	1	2	1	4		MAX WIND			
NE		1	1	1	1	1	1	1		SPEED: 26 KNOTS			
E		1	1	1	1	1	1	1		DIRECTION: 040 DEG			
SE		1	2	0	0	1	0	1		DAY: 17			
S		1	1	1	1	1	1	1		HOUR: 08			
SW		1	1	1	1	1	1	1					
W		1	4	13	2	1	1	1					
NW		1	0	0	1	1	1	1					
CALM		1	1	1	1	1	1	1					
TOTAL		4	26	54	15	14	14	14					

JANUARY										SUMMARY										42001	
AVERAGE LATITUDE 28.0N					AVERAGE LONGITUDE 080.0W																
MEANS AND EXTREMES																					
		MIN		(DA HB)		MEAN		MAX		(DA HB)		NO. OF DAYS WITH									
AIR TEMP (DEG C)		10.0		(10 00)		15.0		22.0		(22 00)		98		1		DATA					
SEA TEMP (DEG C)		20.0		(20 00)		20.5		21.0		(21 00)		98		1		DATA					
AIR-SEA TEMP (DEG C)		10.0		(10 00)		0.5		1.0		(10 00)		98		1		DATA					
PRESSURE (MMHG)		1004.7		(10 00)		1007.3		1009.0		(10 00)		98		1		DATA					
WIND - N FREQUENCIES, MEANS AND EXTREMES																					
		SPEED (KNOTS)				TOTAL SPEED															
		4 11 22 34				4 11 22 34															
DIR		4 10 21 33				47 147															
N		1 2 1 1				2 1															
NE		1 1 1 1				1 1															
E		1 1 1 1				1 1															
SE		1 1 1 1				1 1															
S		1 1 1 1				1 1															
SW		1 1 1 1				1 1															
W		1 1 1 1				1 1															
NW		1 1 1 1				1 1															
CALM		1 1 1 1				1 1															
TOTAL		2 12 44 30				1 100.0				19.8											

FEBRUARY										SUMMARY										42001			
AVERAGE LATITUDE 28.0N												AVERAGE LONGITUDE 080.0W											
MEANS AND EXTREMES																							
AIR TEMP (DEG C)		MIN		(DA HB)		MEAN		MAX		(DA HB)		NO. OF DAYS WITH		DATA									
AIR TEMP (DEG C)		20.0		(20 00)		20.0		22.0		(22 00)		98		1		DATA							
SEA TEMP (DEG C)		20.0		(20 00)		20.5		21.0		(21 00)		98		1		DATA							
AIR-SEA TEMP (DEG C)		0.0		(00 00)		0.5		1.0		(10 00)		98		1		DATA							
PRESSURE (MMHG)		1004.7		(10 00)		1007.3		1007.7		(10 00)		98		1		DATA							
WIND - N FREQUENCIES, MEANS AND EXTREMES																							
SPEED (KNOTS)														MEAN									
														TOTAL SPEED		NO. OF DAYS WITH							
														4		200							
4														10		21							
10														21		33							
21														33		47							
33														47		147							
47														147		1							
1														1		1							
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JANUARY										OCTOBER										SUMMARY										42003																																																																															
AVERAGE LATITUDE 28.0N										AVERAGE LONGITUDE 083.5W																																																																																																			
MEANS AND EXTREMES																																																																																																													
										MIN (DA HB)										MEAN										MAX (DA HB)										NO. OF DAYS WITH																																																																					
AIR TEMP (DEG C)										10.0 (10 21)										15.0										22.0 (22 00)										98										DATA																																																											
SEA TEMP (DEG C)										20.0 (20 21)										20.5										21.0 (21 15)										247										31																																																											
AIR-SEA TEMP (DEG C)										10.0 (10 21)										0.5										1.0 (10 15)										247										31																																																											
PRESSURE (MMHG)										1004.7 (10 00)										1006.2										1008.0 (10 15)										247										31																																																											
WIND - N FREQUENCIES, MEANS AND EXTREMES																																																																																																													
										SPEED (KNOTS)										MEAN										NO. OF DAYS WITH										247																																																																					
DIR										4										11										22										34										47										147										1										1										247																			
N										1										2										1										1										2										1										4										6										MAX WIND																			
NE										1										1										1										1										1										1										1										1										1										SPEED: 30 KNOTS									
E										1										1										1										1										1										1										1										1										DIRECTION: 340 DEG																			
SE										1										1										1										1										1										1										1										1										DOWN: 1%																			
S										1										1										1										1										1										1										1										1										1										1									
SW										1										1										1										1										1										1										1										1										1										1									
W										1										1										1										1										1										1										1										1										1										1									
CALM										1										1										1										1										1										1										1										1										1										1									

[illegible]

NO OF GBS WITH POTENTIAL SUPERSTROKELIKE ICING MODERATE: 1.3% SEVERE: NONE BBS: 240

4 97 995 WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 27.1% SEVERE: NONE 999: 201

N OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 21.5% SEVERE: NONE OBS: 24

\* OF BBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE(4), SEVERE: 4.4% BBS: 22

中国疾病预防控制中心网站：http://www.chinacdc.cn

[illegible]

FEBRUARY		DATA		SUMMARY		AVERAGE LONGITUDE 146.8W		#OBS	
AVERAGE LATITUDE 80.2N									
MEANS AND EXTREMES									
TIME	TEMP (DEG C)	WIND	SEA TEMP (DEG C)	WIND	SEA TEMP (DEG C)	WIND	SEA TEMP (DEG C)	WIND	SEA TEMP (DEG C)
01	-08.4	10	01	-02.9	03	1	02	01	20
02	-08.4	10	02	-02.9	03	1	02	01	20
03	-08.4	10	03	-02.9	03	1	02	01	20
04	-08.4	10	04	-02.9	03	1	02	01	20
05	-08.4	10	05	-02.9	03	1	02	01	20
06	-08.4	10	06	-02.9	03	1	02	01	20
07	-08.4	10	07	-02.9	03	1	02	01	20
08	-08.4	10	08	-02.9	03	1	02	01	20
09	-08.4	10	09	-02.9	03	1	02	01	20
10	-08.4	10	10	-02.9	03	1	02	01	20
11	-08.4	10	11	-02.9	03	1	02	01	20
12	-08.4	10	12	-02.9	03	1	02	01	20
13	-08.4	10	13	-02.9	03	1	02	01	20
14	-08.4	10	14	-02.9	03	1	02	01	20
15	-08.4	10	15	-02.9	03	1	02	01	20
16	-08.4	10	16	-02.9	03	1	02	01	20
17	-08.4	10	17	-02.9	03	1	02	01	20
18	-08.4	10	18	-02.9	03	1	02	01	20
19	-08.4	10	19	-02.9	03	1	02	01	20
20	-08.4	10	20	-02.9	03	1	02	01	20
21	-08.4	10	21	-02.9	03	1	02	01	20
22	-08.4	10	22	-02.9	03	1	02	01	20
23	-08.4	10	23	-02.9	03	1	02	01	20
24	-08.4	10	24	-02.9	03	1	02	01	20
25	-08.4	10	25	-02.9	03	1	02	01	20
26	-08.4	10	26	-02.9	03	1	02	01	20
27	-08.4	10	27	-02.9	03	1	02	01	20
28	-08.4	10	28	-02.9	03	1	02	01	20
29	-08.4	10	29	-02.9	03	1	02	01	20
30	-08.4	10	30	-02.9	03	1	02	01	20
31	-08.4	10	31	-02.9	03	1	02	01	20
TOTAL	15.7	90.7	31.4	2.2	100.0	8.0			





**Table 15**  
**Selected Gale and Wave Observations, North Atlantic**  
**January and February 1979**

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Period sec.	Wave Height ft.	Swell Period sec.		Wave Height ft.
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea					
NORTH ATLANTIC OCEAN																	
JAN.																	
TANPA	AMERICAN	1	24.0 N	79.1 W	00 07	43	10 NM	03	1022.0	24.4	26.7	4	11.5				
OVERSEAS JOYCE	AMERICAN	2	22.3 N	83.6 W	18 36	42	5 NM	02	1029.0	16.7	24.4						
BALTIMORE TRADER	AMERICAN	2	23.6 N	87.5 W	18 02	45	5 NM	02	1024.8	17.2	26.7	3	16.5	02	6	16.5	
RICHARD	LIBRIAN	2	25.5 N	92.4 W	18 34	45	2 NM	02	1032.2	14.0	24.4	4	13	34	7	18	
AMER LEGEND	AMERICAN	3	47.4 N	16.0 W	18 33	48	2 NM	25	998.5	10.0	12.5	8	14.5				
AMER LEGEND	AMERICAN	4	48.4 N	08.4 W	18 20	45	2 NM	25	1000.0	6.6	11.6	8	14.5				
TRANSCOLUMBIA	AMERICAN	5	34.0 N	22.3 W	18 36	45	10 NM	01	1015.9	14.0	18.8	8	8				
CHARLES PIGOTT	LIBRIAN	6	31.9 N	14.4 W	06 04	H 50	5 NM	03	1001.0	14.0	20.0	7	19.5	05	8	16.5	
TRANSCOLUMBIA	AMERICAN	6	33.6 N	22.5 W	00 36	45	10 NM	03	1016.9	15.5	19.8	8	8	05	8	16.5	
ALASKA	AMERICAN	8	36.4 N	72.3 W	18 20	45	2 NM	81	1009.1	20.5	23.3	6	32.5	20	13	32.5	
PURE OIL	AMERICAN	8	25.7 N	86.2 W	06 32	45	< 50 YD	05	1015.0	26.0	25.0	5	6.5				
DELTA BRASIL	AMERICAN	14	19.9 N	95.3 W	12 35	50	2 NM	14	1020.0	20.0	23.5	5	8	34	9	13	
BALTIMORE TRADER	AMERICAN	15	40.4 N	71.7 W	06 32	45	10 NM	02	1007.8	2.2	7.2	4	11.5				
BALTIMORE TRADER	AMERICAN	18	39.0 N	70.9 W	18 31	50	> 5 NM	94	1004.8	1.1	12.2	5	19.5				
PIONEER CRUSADER	AMERICAN	18	49.8 N	08.0 W	06 07	45	5 NM	25	1005.5	4.4	11.1	4	8	05	6	11.5	
CHARLES PIGOTT	LIBRIAN	18	38.9 N	15.6 W	06 21	H 42	10 NM	02	1002.0	19.0	20.0	4	16.5	27	10	6.5	
BALTIMORE TRADER	AMERICAN	19	38.5 N	72.3 W	06 34	55	1 NM	93	1020.5	-1.1	11.7	5	24.5				
THE JUPITER	LIBRIAN	19	38.5 N	68.2 W	06 34	50	1 NM		1009.0	1.7	16.2	7	14.5	34	9	26	
GREEN VALLEY	AMERICAN	19	31.2 N	68.0 W	12 32	H 42	10 NM	02	1018.6	12.3	21.2	8	16.5				
MARCONA TRADER	LIBRIAN	19	35.8 N	62.7 W	12 30	48	2 NM	81	997.2	11.1	22.0	6	10	30	11	19.5	
DEFIANCE	AMERICAN	19	37.2 N	66.7 W	12 34	45	5 NM	82	1012.2	7.2	16.7	13	21	32	> 13	26	
ROBINQUE	AMERICAN	19	35.6 N	72.2 W	06 32	45	5 NM	02	1020.7	10.0	23.5	5	10	32	6	24.5	
ARTHUR MIDDLETON	AMERICAN	20	49.5 N	40.5 W	18 14	44	2 NM	02	997.2	13.4		6	14.5				
SEALAND ECONOMY	AMERICAN	20	36.7 N	43.2 W	00 13	45	5 NM	02	1000.3	14.4	18.9						
JEFF DAVIS	AMERICAN	20	37.6 N	39.5 W	12 17	52	2 NM	02	1001.4	17.2	17.2	7	13	17	10	23	
PIONEER COMMANDER	AMERICAN	20	30.9 N	44.5 W	06 18	50	5 NM	02	1002.0	20.5	18.9						
EXPORT BAY	AMERICAN	20	36.1 N	50.7 W	18 29	45	5 NM	27	1005.0	13.3	18.8	4	10	29	7	26	
TEXACO FLORIDA	AMERICAN	21	27.9 N	87.1 W	18 29	50	5 NM	02	1009.8	12.0	20.9	3	6.5	29	7	11.5	
AMER EXPLORER	AMERICAN	21	35.0 N	74.0 W	18 20	45	2 NM	07	990.0	20.5	24.5	6	29.5	20	10	37.5	
ARCTIC	AMERICAN	21	36.0 N	71.3 W	18 20	42	5 NM	02	990.8	18.9	23.5	2	10	20	8	13	
KEYSTONE	AMERICAN	21	26.5 N	91.1 W	18 31	45	5 NM	02	1014.0	16.7	21.7	5	13	31	10	19.5	
MARCONA CONVEYOR	LIBRIAN	21	36.7 N	74.7 W	18 19	H 43	2 NM	02	987.0	17.2	13.5	6	16.5				
CELTIC LIVES	AMERICAN	21	27.7 N	89.9 W	18 31	48	10 NM	02	1011.5	19.9	19.4	5	24.5	31	8	24.5	
CHALLENGER	LIBRIAN	21	31.3 N	13.8 W	12 30	41	5 NM	02	1001.3	17.0	17.5	9	13	27	7	13	
HOGAR M QUEENY	AMERICAN	21	25.5 N	85.4 W	19 28	45	10 NM	02	1018.5	20.6	24.5	4	10	28	11	23	
GULFBANKER	AMERICAN	21	26.9 N	91.5 W	12 33	44	10 NM	01	1009.0	14.0	20.0	4	10				
TEXACO FLORIDA	AMERICAN	22	28.3 N	87.5 W	00 29	45	10 NM	02	1013.9	12.0	19.4	3	6.5	29	6	8	
SEALAND GALLOWAY	AMERICAN	22	35.5 N	24.7 W	00 16	45	5 NM	25	1003.6	15.0	14.5						
AMER EXPLORER	AMERICAN	22	34.4 N	74.0 W	00 22	45	5 NM	09	993.7	20.0	24.5	7	29.5	21	10	34.5	
SUGAR ISLANDER	AMERICAN	23	28.8 N	36.5 W	06 29	48	10 NM	03	1003.7	17.3							
SEALAND GALLOWAY	AMERICAN	24	39.8 N	54.7 W	08 30	45	5 NM	02	1003.1	19.0	18.2	11	14.5				
MAYAGUEZ	AMERICAN	25	31.0 N	72.8 W	06 25	45	2 NM	00	1000.3	5.0	10.4	3	5				
MARCONA CONVEYOR	LIBRIAN	25	31.7 N	79.8 W	00 28	H 45	5 NM	02	1004.5	5.0	10.4	3	5	25	< 6	11.5	
COLORADO	AMERICAN	25	34.8 N	75.6 W	06 25	45	> 25 NM	00	999.0	15.8		4	14.5				
ROBINQUE	AMERICAN	25	34.8 N	75.6 W	06 25	45	5 NM	03	997.0	8.0	16.7	5	8	22	6	10	
SEALAND VENTURE	AMERICAN	25	31.8 N	69.2 W	18 27	41	5 NM	25	1005.1	16.6	20.0	5	10	27	12	32.5	
STAGBOND	AMERICAN	25	39.2 N	45.7 W	00 31	45	5 NM	81	990.8	10.0	18.9	4	10	29	9	11.5	
QUEBEC	AMERICAN	25	37.1 N	49.3 W	12 31	35	5 NM	81	987.6	13.4	18.4	5	16.8	30	6	32.5	
QUEBEC	AMERICAN	25	35.4 N	62.3 W	18 31	40	10 NM	02	1001.7	14.1	21.1						
QUEBEC	AMERICAN	26	35.8 N	40.8 W	00 31	40	10 NM	03	1000.7	15.6	18.3						
MAYAGUEZ	AMERICAN	29	34.6 N	74.5 W	00 32	50	10 NM	02	1000.1	10.9	21.0	5	5	32	6	29.5	
MORCONASAGA	AMERICAN	29	31.4 N	86.4 W	21 25	45	5 NM	02	993.0	18.9	20.0	7	24.5	29	7	24.5	
MORCONASAGA	AMERICAN	29	28.5 N	84.5 W	18 27	47	5 NM	02	1003.1	23.4	20.0	7	10				
MORIL AERO	AMERICAN	29	39.3 N	72.5 W	18 32	45	10 NM	02	991.9	4.4	8.8	8	11.5	32	> 13	24.5	
DELAWARE II	AMERICAN	29	38.2 N	75.1 W	18 30	H 45	10 NM	02	999.0	5.6	3.9						
ROBERT E LEE	AMERICAN	29	36.3 N	62.0 W	12 29	H 50	5 NM	13	980.7	13.4	16.6	8	19.5	27	7	24.5	
AFRICAN HETERO	AMERICAN	29	34.8 N	59.4 W	18 27	43	5 NM	02	985.4	16.0	19.2	10	14.5				
AFRICAN HETERO	AMERICAN	29	32.0 N	71.7 W	06 28	45	10 NM	02	1009.1	16.7	20.0	3	10	29	7	11.5	
AFRICAN HETERO	AMERICAN	30	32.1 N	71.8 W	06 28	45	10 NM	02	1009.1	10.0	21.1						
MORIL AERO	AMERICAN	30	40.1 N	70.8 W	06 32	45	10 NM	02	992.2	3.3	6.1	8	11.5	32	> 13	19.5	
MORCONASAGA	AMERICAN	30	32.6 N	87.9 W	21 25	45	5 NM	02	992.5	17.8	18.9	6	24.5	28	7	19.5	
RED JACKET	AMERICAN	30	39.1 N	81.3 W	06 25	45	5 NM	02	979.2	11.2	15.7	6	24.5				
ROBERT E LEE	AMERICAN	30	36.1 N	62.9 W	06 29	H 50	5 NM	18	989.0	13.4	12.2	7	13	27	9	24.5	
AFRICAN HETERO	AMERICAN	30	34.8 N	81.4 W	06 27	45	5 NM	13	987.5	16.0	16.2	10	26				
ROBERT E LEE	AMERICAN	31	36.1 N	83.8 W	06 30	H 45	2 NM	02	995.0	12.4	14.9	7	13	30	9	26	
PROSPERITY QUEEN	SINGAPORE	31	47.5 N	13.4 W	18 17	H 46	2 NM	62	995.0	12.0	12.0			17	9	14.5	
AFRICAN HETERO	AMERICAN	31	36.0 N	84.2 W	06 30	45	5 NM	02	992.2	16.4	16.2	10	26				
EXPORT CHAMPION	AMERICAN	31	36.5 N	86.8 W	18 24	42	5 NM	01	980.4	16.7	16.7	4	10	26	> 13	36	
MORCONASAGA	AMERICAN	31	33.1 N	98.5 W	12 29	45	5 NM	82	995.2	15.5	18.3	6	24.5				
GREAT LAKES VESSELS																	
ERNEST R BREECH	AMERICAN	4	45.2 N	83.2 W	18 26	H 44	10 NM	02		-12.0	2.0	3	10				
G. M. MUMPHREY	AMERICAN	4	47.7 N	89.2 W	12 33	H 42	1 NM	72		-14.0	2.0	5	8				
THOMAS F. RAYTON	AMERICAN	14	43.3 N	87.6 W	06 34	H 50	1 NM	22		-7.0	2.0	5	14.5				
ENVIRONMENTAL BUOYS																	
41001	AMERICAN	3	35.0 N	72.0 W	06 18	M 41				1012.0	21.6	21.4	9	16.5			
41001	AMERICAN	21	35.0 N	72.0 W	18 19	M 43				995.8	21.1	20.4	9	16.5			
44005	AMERICAN	18	42.7 N	68.5 W	21 04	M 48				999.3	-0.7	6.4	7	13			
44005	AMERICAN	25	42.7 N	68.5 W	12 08	M 46				991.6	-0.1	6.5	8	14.5			
NORTH ATLANTIC OCEAN																	
FEB.																	
AMER LEADER	AMERICAN	1	33.5 N	65.8 W	18 27	45	10 NM	02	998.5	10.0	20.0	5	10	27	> 13	19.5	
AMER ARGOSEY	AMERICAN	1	32.8 N	71.2 W	16 31	43	10 NM	01	1003.2	12.8	19.4	5	10.5	31	10	24.5	
PROSPERITY QUEEN	SINGAPORE	1	33.7 N	11.7 W	18 28	35	10 NM	02	987.0	12.0	11.0	14	16.5				
BALTIMORE TRADER	AMERICAN	1	37.3 N	75.0 W	18 32	92</											

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind Dir <sup>10</sup>	Speed kt	Visibility n. mi.	Present Weather	Pressure mb.	Temperature °C		Sea Period sec	Wave Height ft	Wind Dir <sup>10</sup>	Wind Speed mph	Wave Height ft
			Lat. deg.	Long. deg.							Air	Sea					
NORTH ATLANTIC OCEAN																	
BALTIMORE TRADER	AMERICAN	2 FEB.	38.0 N	73.2 W	00	32	35	2 NM	26	1003.2	1.1	11.1	5	24.5	32	X	45
EXPORT CHAMPION	AMERICAN	3	37.3 N	80.8 W	00	27	35	10 NM	14	982.0	14.0	14.7	5	29.3	20	113	42
OTTO N MILLER	LIBYAN	3	37.1 N	45.5 W	12	23	M 41	10 NM	19	1012.0	24.0	21.1	5	13	31	10	11.5
YOUNG AMERICA	AMERICAN	3	37.0 N	76.0 W	12	23	45	2 NM	24	997.0	18.8	12.2	7	16.3	23	8	24.5
OTTO N MILLER	LIBYAN	4	29.3 N	48.0 W	12	26	M 41	10 NM	13	1009.5	20.0	20.0	8	16.3			
YOUNG AMERICA	AMERICAN	4	37.0 N	76.8 W	00	23	40	10 NM	03	991.9	18.5	15.0	7	10.5	23	8	32.5
EXPORT CHAMPION	AMERICAN	5	40.7 N	69.1 W	00	34	40	5 NM	40	997.5	10.0	17.8	3	14.5	34	13	32.5
BALTIMORE TRADER	AMERICAN	5	37.8 N	69.1 W	18	27	45	2 NM	24	999.5	10.0	14.5	13	14.5			
AMER ACE	AMERICAN	6	38.0 N	81.6 W	12	27	45	5 NM	80	995.3	8.7	14.3	9	19.5			
AMER LEGACY	AMERICAN	6	40.6 N	88.6 W	00	28	45	5 NM	15	1000.5	0.0	4.5	5	13	28	7	16.5
INSHAM	AMERICAN	6	39.2 N	81.5 W	12	29	41	5 NM	14	1005.8	19.6	16.2	10	14.5	24	6	8
GOLDEN DOLPHIN	AMERICAN	6	39.0 N	59.7 W	18	29	50	5 NM	46	989.2	4.4	16.2	3	6.3	29	8	24.5
EXPORT CHAMPION	AMERICAN	6	39.0 N	53.9 W	18	29	80	2 NM	85	999.7	3.4	15.0	5	11.5	30	10	39
CASH PACIFIC	AMERICAN	6	31.3 N	92.0 W	21	27	M 32	2 NM	02	1004.4	18.3	17.8	8	19.5	27	7	14.3
OTTO N MILLER	LIBYAN	6	34.4 N	54.4 W	18	26	M 34	5 NM	82	996.0	19.5	16.7	8				
BALTIMORE TRADER	AMERICAN	6	38.8 N	71.2 W	06	30	50	5 NM	02	1010.5	10.6	5	24.8	30	6	24.8	
YOUNG AMERICA	AMERICAN	6	36.6 N	59.3 W	18	29	55	1 NM	18	992.5	10.0	15.0	6	14.5		8	21
INSHAM	AMERICAN	7	32.9 N	62.8 W	00	30	41	5 NM	10	1014.4	14.3	10.2	23	25	6	8	1
AMER ACE	AMERICAN	7	37.5 N	35.1 W	06	28	45	5 NM	27	999.3	12.8	18.9	9	19.8	28	10	32.5
EXPORT CHAMPION	AMERICAN	7	39.0 N	54.2 W	00	30	45	2 NM	87	1000.5	2.9	13.0	5	16.5	30	10	32.5
EXPORT LEADER	AMERICAN	7	44.0 N	62.0 W	06	28	45	10 NM	02	994.0	5.5	2.8	2	6.5	27	7	14.5
GOLDEN DOLPHIN	AMERICAN	7	39.9 N	37.0 W	18	30	55	10 NM	23	1004.1	9.4	18.9	5	10	30	8	24.5
OTTO N MILLER	LIBYAN	7	34.8 N	34.6 W	00	26	M 48	5 NM	18	1000.0	19.8	17.3	8	23			
CASH PACIFIC	AMERICAN	7	31.1 N	33.9 W	06	27	M 45	10 NM	05	1011.9	18.3	17.8	8	10			
HORMACHAVE	AMERICAN	7	35.3 N	71.0 W	18	18	45	2 NM	60	1004.5	15.3	20.0	5	8	18	9	14.5
HORMACHAVE	NORWEGIAN	8	36.2 N	78.3 W	18	24	45	10 NM	15	993.0	19.0	16.0	7	19.5			
GEORGE WALTON	AMERICAN	8	36.0 N	39.1 W	12	23	45	10 NM	02	994.9	13.3	17.3	4	14.5	23	6	14.5
HORMACHAVE	AMERICAN	8	37.9 N	72.3 W	06	32	45	10 NM	15	1011.0	10.0	11.7	5	8	32	9	19.5
HORMACHAVE	DANISH	8	38.5 N	32.5 W	12	27	M 42	10 NM	15	989.2	12.7	10	13	10	19.5	27	13
OTTO N MILLER	LIBYAN	8	37.6 N	58.4 W	16	23	M 45	5 NM	07	997.0	21.0	17.8	7	16.5			
SEALAND RESOURCE	AMERICAN	8	50.3 N	34.3 W	00	09	45	5 NM	82	979.8	10.0	10.6	6	16.8	09	113	19.5
GEORGE WALTON	AMERICAN	9	35.0 N	32.2 W	18	24	45	5 NM	82	998.3	16.7	18.3	4	10.5	24	6	19.5
HORMACHAVE	NORWEGIAN	9	35.0 N	38.7 W	18	24	45	2 NM	84	997.0	16.9	16.5	8	19.5	28	4	28
EDMONTA	DANISH	9	40.6 N	28.7 W	00	26	M 44	2 NM	97	978.2	13.3	10.0	10	14.5	28	13	28
OTTO N MILLER	LIBYAN	9	38.0 N	89.0 W	00	28	M 45	5 NM	07	1000.0	10.3	17.7	7	18			
GEORGE WALTON	AMERICAN	10	34.7 N	33.1 W	00	27	45	5 NM	01	1005.0	16.7	17.8	4	10.5	27	8	18
OXFORD JARRESTOWN	AMERICAN	10	33.2 N	76.9 W	00	33	50	30 VD	44	1018.0	8.2	23.8	5	6.5	21	8	11.5
SUSQUEHANNA	AMERICAN	10	34.6 N	21.7 W	12	30	50	5 NM	60	1000.0	22.0	18.9	8				
ADM W M CALLAGHAN	AMERICAN	10	49.2 N	40.3 W	12	28	42	5 NM	30	989.2	5.0	12.7	6	18	29	9	19.5
EXPORT FREEDOM	AMERICAN	11	37.0 N	13.1 W	00	31	45	5 NM	81	992.2	13.4	16.2	5	10	23	10	24.5
AMER CHALLENGER	AMERICAN	11	48.8 N	35.6 W	12	08	45	10 NM	02	959.0	10.0	10.2	6	14.5			
AMER RACER	AMERICAN	11	40.5 N	11.1 W	00	32	60	10 NM	02	1017.0	6.7	5.0	8	10			
CHEERY VALLEY	AMERICAN	12	48.0 N	11.7 W	12	27	45	2 NM	02	1009.7	15.0	12.8	8				
BARNA	NORWEGIAN	12	45.0 N	22.1 W	12	27	M 45	5 NM	07	989.0	15.0	13.0	10	29	8	10	
PIONEER COMMANDER	AMERICAN	12	41.6 N	66.3 W	00	32	45	5 NM	70	1018.5	15.5	8.3	4	6.5	32	6	10
AMER LEGEND	AMERICAN	12	50.3 N	41.8 W	12	28	50	2 NM	69	976.6	2.3	6.7	7	24.5	28	4	13
AMER LEGEND	AMERICAN	13	49.4 N	44.7 W	00	29	45	2 NM	85	984.1	4.4	7.2	8				
MARIA TOPIC	LIBYAN	13	34.8 N	70.2 W	18	34	80	1 NM	89	1012.0	10.0	18.0	8	21			
EXPORT FREEDOM	AMERICAN	13	44.6 N	31.0 W	18	28	46	10 NM	03	1015.9	16.8	16.1	5	10			
BARNA	NORWEGIAN	13	44.6 N	23.6 W	00	27	M 50	2 NM	02	996.0	10.0	19.0	8	29.5	28	8	19.5
LIGHTNING	AMERICAN	14	39.8 N	42.3 W	12	18	60	5 NM	02	1001.0	19.7	16.2	3	6.5	18	9	16.5
BARNA	NORWEGIAN	14	42.5 N	29.0 W	00	28	M 49	5 NM	02	1010.0	19.0	14.0	3	23	28	113	16.5
LIGHTNING	AMERICAN	15	39.6 N	36.8 W	00	18	30	2 NM	25	1009.8	16.3	14.9	3	18.5	18	9	16.5
GREAT REPUBLIC	AMERICAN	15	43.6 N	30.7 W	00	21	42	5 NM	02	1011.3	18.0	18.0	5	10	XX	2	19.5
AMER LEADER	AMERICAN	17	49.5 N	37.5 W	18	26	42	10 NM	27	990.3	9.0	10.6	4	11.5	28	12	23
BARNA	NORWEGIAN	17	36.2 N	48.0 W	12	22	M 45	1 NM	07	1005.0	18.0	18.0	6	13	25	113	19.5
SEALAND ECONOMY	AMERICAN	17	36.2 N	48.0 W	12	22	M 45	1 NM	07	1005.0	18.0	18.0	6	13	25	113	19.5
DUVI KATSEAT	NORWEGIAN	18	49.9 N	36.8 W	18	23	55	5 NM	16	1004.4	1.7	13.0	4	6	11.8	24	11
PAGLE CHARGER	AMERICAN	18	31.8 N	79.5 W	00	03	50	2 NM	03	1026.8	11.1	22.2	8	11.5	05	8	21
TEXAS TRADER	AMERICAN	18	31.3 N	78.5 W	18	09	45	2 NM	16	1020.7	18.3	22.9	5	14.5	09	7	18
AMER LEADER	AMERICAN	19	43.5 N	43.0 W	18	31	45	10 NM	98	1019.0	1.3	13.6	6	8			
AMER ARGOSY	AMERICAN	19	37.1 N	30.7 W	06	19	55	5 NM	03	985.0	4.4	7.8	8	29.5			
PAGLE CHARGER	AMERICAN	19	38.5 N	74.1 W	18	02	64	5 NM	79	999.7	9.4	9.6	3	19.3	XX	6	19.5
VALLEY HORSE	AMERICAN	19	34.9 N	73.2 W	12	28	35	30 VD	46	1016.6	8.9	21.2	9	14.5	18	7	19.5
VALLEY HORSE	AMERICAN	19	34.1 N	76.7 W	12	30	45	200 VD	45	1021.8	1.1	17.8	5	6.5			
AMER LEADER	AMERICAN	20	43.5 N	43.9 W	00	31	45	10 NM	98	1020.0	2.0	15.6	6	10	32	113	23
SEALAND VENTURE	AMERICAN	20	39.5 N	06.3 W	18	18	45	5 NM	02	1011.2	8.3	8.9	5	6.5	27	7	14.5
NORMACRIGEL	LIBYAN	20	32.0 N	93.1 W	12	30	M 45	5 NM	02	1020.0	17.0	19.4	7	8	30	10	16.5
CHEVROD PERNIS	SWEDISH	20	37.4 N	60.3 W	18	34	M 44	5 NM	03	1017.5	16.0	17.8	18	18	XX	X	26.5
ODON CARLOS	SWEDISH	20	39.2 N	54.3 W	18	23	60	5 NM	28	996.5	18.0	14.0	XX	23			
TANPA	AMERICAN	20	39.2 N	54.3 W	18	23	60	5 NM	28	996.5	18.0	14.0	XX	23			
SEALAND RESOURCE	AMERICAN	21	41.2 N	67.3 W	18	35	70	2 NM	50	1004.0	6.8	12.8	5	26.5	36	113	46
SEALAND VENTURE	AMERICAN	21	39.0 N	18.1 W	18	23	47	5 NM	40	1005.3	9.9	8.9	6	10	23	12	26.5
ODON CARLOS	SWEDISH	21	35.0 N	35.4 W	00	31	45	5 NM	01	1000.7	15.0	14.0	XX	26			
MORSH ORCHID	NORWEGIAN	21	35.8 N	43.2 W	18	27	48	25 NM	51	992.0	10.0	14.0	11	26.5			
HORMACHAVE	NORWEGIAN	22	36.0 N	44.0 W	06	31	45	2 NM	02	1011.0	11.5	14.0	11	26			
SEALAND VENTURE	AMERICAN	22	39.1 N	20.2 W	00	25	47	5 NM	90	1006.1	2.8	8.9	6	10	23	12	29.5
SEALAND RESOURCE	AMERICAN	22	41.3 N	49.1 W	00	36	45	10 NM	81	1018.0	2.4	14.0	8	19.5	03	113	29.5
SEALAND VENTURE	AMERICAN	23	36.4 N	36.0 W	12	01	45	2 NM	51	1007.6	3.3	9.1	6	10	36	8	29
SEALAND VENTURE	AMERICAN	24	33.4 N	40.9 W	00	33	45	5 NM	02	1007.8	2.6	9.6	6	10	36	8	29
BALTIMORE TRADER	AMERICAN	26	34.4 N	73.9 W	06	19	45	5 NM	00	1009.8	18.9	19.4	3	11.3	20	6	16.5
SEALAND VENTURE	AMERICAN	27	33.8 N	66.5 W	12	18	45	5 NM	08	1012.0	19.3	20.0	3	10	18	12	6.5
ENVIRONMENTAL BUOYS																	
44004	AMERICAN	19	39.0 N	70.0 W	21	05	M 55			1002.7	6.8	12.4	8	13			
44004	AMERICAN	20	39.0 N	70.0 W	00	03	M 52			1011.2	6.3	11.7	8	6.5			
+ Direction for sea waves same as wind direction.																	
NOTE: The above information is for informational purposes only and is not to be used for navigation.																	

\* Direction for sea waves same as wind direction  
X Direction or period of waves indeterminate  
M Measured wind

NOTE: The observations are selected from those with winds > 35 km or waves > 25 ft from May through August (2-3) km or > 20 ft, September through April. In cases where a ship reported more than one observation a day with such values, the one with the highest wind speed was selected.

**Table 16**  
**Selected Gale and Wave Observations, North Pacific**  
**January and February 1979**

Vessel	Nationality	Date	Position of Ship		Time GMT	Dir. 10°	Speed kt	Wind	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves		Swell Waves		
			Lat. deg.	Long. deg.								Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN																		
JAN.																		
PHILADELPHIA	AMERICAN	1	52.7 N	134.0 W	00	14	35	2 NM	05	1015.9	4.6	7.8	3	16.5	14	6	29.5	
ARLON MARSK	DANISH	2	34.3 N	149.2 W	18	30	45	5 NM	01	1000.0	15.0		5	8	30	8	26	
AVESTA	SWEDISH	2	37.2 N	159.1 W	00	34	42	10 NM	01	999.0	12.8		6	16.5				
AVESTA	SWEDISH	3	35.8 N	171.5 W	18	18	45	10 NM	02	989.0	16.4		6	16.5				
AMER ASTRONAUT	AMERICAN	3	13.6 N	94.7 W	18	56	60	5 NM	07	1018.0	16.7	17.8	7	10	36	213	19.5	
AVESTA	SWEDISH	4	35.5 N	178.2 W	18	27	45	5 NM	13	1005.5	10.8		6	10	28	13	16.5	
TOYOTA MARU #12	JAPANESE	7	32.6 N	139.3 W	00	20	45	5 NM	02	1008.5	17.5	17.0	5	8	23	8	14.5	
VICTORY	LIBYAN	8	34.2 N	147.4 W	18	20	51	5 NM	01	999.0	18.0	18.0	10	13	25	12	14.5	
NANCY LYKES	AMERICAN	8	27.0 N	146.1 W	00	23	55	5 NM	02	997.6	21.6	22.1	7	19.5				
CHESTNUT HILL	AMERICAN	9	45.0 N	145.3 W	00	16	45	1 NM	12	982.6	11.7	10.0	8	19.5				
7TH MONTREAL	LIBYAN	9	34.0 N	143.5 W	00	25	45	2 NM	02	1003.0	18.0		3	6.5	25	7	8	
TOHOKU MARU	JAPANESE	9	33.0 N	144.1 W	00	20	43	2 NM	15	1015.0	19.5	19.5	3	11.5	26	6	14.5	
TOYOTA MARU # 10	JAPANESE	9	36.9 N	141.7 W	00	18	42	5 NM	01	1003.0	17.5	17.0	4	10	21	7	16.5	
PAIDUKS	LIBYAN	9	11.5 N	192.0 W	00	08	42	1 NM	10	1013.0	24.0	25.0	12	10	08	12	13	
TOYOTA MARU # 10	JAPANESE	10	39.6 N	151.6 W	18	20	50	10 NM	03	989.5	12.0	15.5	4	6.5	23	7	19.5	
PHILADELPHIA	AMERICAN	10	55.8 N	143.1 W	06	11	45	2 NM	01	995.5	6.2	5.0	5	18	13	6	26	
PACIFIC VENTURE	PANAMANIAN	10	40.9 N	178.2 E	18	29	47	2 NM	03	1007.0	6.0	10.0	14	24.5				
PACIFIC VENTURE	PANAMANIAN	11	40.9 N	178.7 E	00	29	42	2 NM	07	1007.3	4.0	10.5	14	29.5				
PACIFIC WING	PANAMANIAN	11	35.5 N	145.3 W	18	31	48	5 NM	41	1016.5	10.0	14.0	7	19.5				
ORIENTAL EXECUTIVE	LIBYAN	12	38.0 N	140.2 W	00	25	46	2 NM	03	1010.0	14.0							
PACIFIC HUNT	LIBYAN	12	48.7 N	174.4 W	00	20	45	5 NM	03	999.8	4.5	8.0	9	11.5	24	13	15	
SEALAND FINANCE	AMERICAN	12	59.2 N	176.9 E	12	25	45	10 NM	02	986.0	-2.8	2.2	6	19.5	25	213	26	
SEALAND FINANCE	AMERICAN	13	51.0 N	172.0 E	18	25	45	5 NM	70	988.0	-2.8	2.2	4	13	25	10	19.5	
PACIFIC HUNT	LIBYAN	13	46.8 N	178.2 E	00	19	46	2 NM	01	999.0	7.0	8.0	9	13	23	13	11.5	
POLYMYNIA	NORWEGIAN	13	30.1 N	150.5 E	06	05	30	2 NM	01	990.0	13.0	20.0						
VANGUARD	LIBYAN	13	51.1 N	175.1 W	00	17	42	2 NM	30	993.0	5.0	6.0			20	11	24.5	
ORIENTAL EDUCATOR	BRITISH	13	33.7 N	142.8 E	18	23	50	2 NM	01	991.5	20.0	20.0	3	6.5	22	8	13	
GREAT OCEAN	JAPANESE	13	37.6 N	143.8 E	11	08	50	10 NM	03	998.0	8.0	16.0	6	10	32	6	10	
HONGKONG PHOENIX	SINGAPORE	13	32.0 N	147.0 E	06	26	45	10 NM	18	996.0	20.0		7	24.5	08	7	13	
ARCTIC TOKYO	LIBYAN	14	54.3 N	165.1 W	18	10	44	2 NM	05	985.0	2.0	4.0	6	13				
POLAR ALASKA	LIBYAN	14	40.1 N	166.6 E	06	25	42	5 NM	02	1007.0	-1.0	8.0	6	11.5				
BRES JEFFERSON	AMERICAN	14	39.4 N	171.0 E	06	23	40	2 NM	00	980.0	10.0	13.9	8	28	23	9	29.5	
SEATRAN BUNKER HILL	FRENCH	14	37.0 N	170.7 E	18	26	49	5 NM	21	1000.0	11.5	16.0						
TOYOTA MARU # 10	JAPANESE	14	36.7 N	173.2 W	06	18	41	5 NM	03	1019.5	10.0	16.0	6	8	27	12	19.5	
ORIENTAL EDUCATOR	BRITISH	14	33.8 N	165.2 E	00	23	42	2 NM	02	999.5	19.0	20.0	3	6.5	23	8	16.5	
NEW ENGLAND HUNTER	LIBYAN	14	32.5 N	140.1 W	18	29	44	2.5 NM	03	1018.0	17.0	14.0	4	10	30	6	19.5	
EXON NEW ORLEANS	AMERICAN	14	40.9 N	131.8 W	18	08	50	5 NM	50	986.1	9.1	10.6	7	18	07	9	18	
GREAT OCEAN	JAPANESE	14	38.1 N	148.3 E	05	31	43	10 NM	01	997.5	9.5	14.0	7	13	31	10	16.5	
AUSTRAL MOON	AMERICAN	14	43.1 N	124.8 W	12	18	35	10 NM	02	1000.5	6.7	11.2	5	16	10	10	32.5	
CHEVRON ARIZONA	AMERICAN	14	46.1 N	130.3 E	12	08	45	5 NM	03	987.5	7.8		4	13	12	9	19.5	
ARNOLD MAERSK	DANISH	14	36.2 N	166.4 E	02	23	35	10 NM	07	997.0	15.0		14	32.5				
SEATRAN BUNKER HILL	FRENCH	15	37.1 N	172.0 E	00	27	45	5 NM	21	1008.0	10.0	14.0	3	13	22	9	8	
POLYMYNIA	NORWEGIAN	15	35.7 N	146.2 E	18	14	45	5 NM	03	1012.0	12.0	17.0	5	5	24	9	8	
PRESIDENT MADISON	LIBYAN	15	28.4 N	126.7 E	00	36	45	5 NM	02	1024.0	12.2	20.6	6	6.5	20	6	10	
ORIENTAL EXECUTIVE	LIBYAN	15	35.6 N	127.8 E	00	27	42	5 NM	02	1000.0	15.0							
PACIFIC WING	PANAMANIAN	15	35.0 N	137.6 W	00	31	45	2 NM	60	1011.5	18.0	14.0	3	11.5	31	8	21	
VAN WARRIOR	LIBYAN	15	50.7 N	168.7 W	06	24	35	5 NM	08	974.0	6.0	7.0	5	24.5	24	6	41	
GREAT OCEAN	JAPANESE	16	41.1 N	173.3 W	23	20	45	10 NM	02	1001.5	12.5	11.0	7	11.5	17	8	13	
JAPAN RATON	JAPANESE	16	52.4 N	170.8 W	00	29	45	10 NM	03	982.0	3.0	5.0	5	10	28	17	19.5	
POLYMYNIA	NORWEGIAN	16	35.8 N	171.5 E	12	24	45	5 NM	03	1008.0	19.0	17.0	5	5	24	9		
PACIFIC HUNT	LIBYAN	16	46.7 N	167.5 E	00	26	45	5 NM	08	997.7	1.0	5.0	7	10	26	12	13	
BRES JEFFERSON	AMERICAN	16	42.3 N	168.2 E	00	27	45	10 NM	02	1007.2	10.0	10.0	7	19.5	27	10	24.5	
VAN ENTERPRISE	LIBYAN	17	46.8 N	138.8 E	06	30	45	5 NM	01	1017.5	9.0	10.0						
PACIFIC HUNT	LIBYAN	17	45.7 N	163.7 E	00	27	35	10 NM	01	999.8	0.2	5.0	8	13	29	13	16.5	
SUNNY PIONEER	PANAMANIAN	17	46.4 N	162.4 E	00	29	45	5 NM	12	996.0	0.0	0.0						
ARCTIC TOKYO	LIBYAN	17	50.8 N	165.7 E	12	27	47	2 NM	26	987.0	-4.0	5.0	5	10				
PHILADELPHIA	AMERICAN	17	58.6 N	149.6 W	00	27	45	10 NM	02	980.7	3.9	5.6	3	11.5	27	213	23	
EXON SAN FRANCISCO	AMERICAN	18	34.2 N	138.6 W	18	27	45	5 NM	02	994.2	6.3	6.1	4	10	28	9	26	
HONSHU GLORIA	LIBYAN	18	43.0 N	156.3 E	18	18	47	2 NM	77	997.0	2.0	6.0						
EXON RATON ROUGE	AMERICAN	18	48.0 N	133.2 W	18	21	45	2 NM	02	1006.4	10.0	6.7	3	5	26	8	18	
VAN WARRIOR	LIBYAN	18	48.2 N	172.8 E	12	27	35	10 NM	70	992.0	1.5	6.0						
CHEVRON OREGON	AMERICAN	18	56.8 N	140.5 W	18	25	50	5 NM	18	976.0	5.0		3	13	25	9	21	
VANGUARD	LIBYAN	18	39.0 N	140.3 E	03	22	54	25 NM	99	1005.0	12.0	16.0			22	6	32.5	
SUNNY PIONEER	PANAMANIAN	18	43.2 N	152.7 E	18	05	41	500 YD	45	983.0	0.0	-0.1						
PACIFIC HUNT	LIBYAN	18	45.0 N	160.3 E	00	27	45	2 NM	23	1004.2	-0.5	5.0	8	13	28	13	16.5	
SEATRAN VALLEY FORGE	SINGAPORE	18	34.1 N	149.4 E	18	22	57	2 NM	03	992.3	16.0	18.0						
ARCTIC TOKYO	LIBYAN	18	49.8 N	163.3 E	00	32	47	5 NM	02	993.0	-3.0	1.0	5	6.5				
ONTARIO	AMERICAN	18	54.4 N	138.7 W	12	20	45	10 NM	02	984.1	4.4	5.0	5	13	20	6	26	
FRIDTJOF	LIBYAN	19	41.5 N	174.8 W	00	29	42	2 NM	10	1006.5	10.0	11.0	10	14.5	28	12	19.5	
EXON SAN FRANCISCO	AMERICAN	19	55.2 N	139.5 W	00	27	45	5 NM	27	999.5	6.0	6.0	6	24.5	28	8	28	
HONSHU GLORIA	LIBYAN	19	43.3 N	151.3 E	12	32	55	5 NM	56	981.5	4.2	7.0						
CHEVRON OREGON	AMERICAN	19	57.5 N	141.6 W	01	27	50	10 NM	01	990.9	3.9		4	14.5	26	11	24.5	
VANGUARD	LIBYAN	19	35.8 N	187.5 E	00	20	45	2 NM	03	992.0	17.0	16.0			23	10	19.5	
PACIFIC HUNT	LIBYAN	19	44.5 N	156.6 E	00	03	45	200 YD	78	977.5	-1.0	5.0	9	11.5	04	12	13	
SUNNY PIONEER	PANAMANIAN	19	42.5 N	151.0 E	00	02	45	30 YD	45	983.0	0.4	0.0	5	14.5				
PHILADELPHIA	AMERICAN	19	58.2 N	148.0 W	00	24	45	10 NM	02	988.8	2.8	6.1	3	11.5	24	213	23	
HONSHU GLORIA	LIBYAN	20	43.0 N	164.7 E	00	29	45	25 NM	03	990.8	2.1	7.0	7	19.5	29	213	34.5	
JAPAN RATON	JAPANESE	20	46.9 N	145.3 E	00	30	45	2 NM	31	982.0	1.0	2.0	5	11.5	24	6	10	
VAN WARRIOR	LIBYAN	20</																

Vessel	Nationality	Date	Lat. deg.	Long. deg.	Time GMT	Dir. 10°	Wind Speed kt	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature Air °C	Temperature Sea °C	Sea Wave? Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.	
NORTH PACIFIC OCEAN																		
JAN.																		
VAN ENTERPRISE	LIBRIAN	22	43.6 N	170.1 W	18	20	M 30	1 NM	80	1009.0	8.0	5.0	5	19.5	23	7	19.5	
ZENLIN GLORY	LIBRIAN	22	35.9 N	160.3 E	00	23	M 33	2 NM	11	1011.0	17.0	20.0	10	13	23	10	32.9	
PRESIDENT MADISON	AMERICAN	22	38.8 N	149.0 E	00	20	M 43	5 NM	81	1011.0	17.0	19.5	10	13	23	10	32.9	
ROOLETTO	SWEDISH	22	34.6 N	139.8 W	00	34	M 44	5 NM	02	1011.0	16.0	18.0	7	10	34	10	24.9	
HONSHU GLORIA	LIBRIAN	23	42.9 N	172.8 W	00	23	M 44	5 NM	30	1011.5	11.6	10.0	5	11.5	22	13	19.9	
VAN ENTERPRISE	LIBRIAN	23	43.1 N	171.3 W	00	21	M 43	2 NM	81	1013.0	10.0	5.5	3	8	24	8	34.5	
EXKON BATON ROUGE	AMERICAN	24	43.7 N	129.4 W	18	33	M 45	10 NM	18	1012.5	9.5	8.8	2	6.5	31	7	16.3	
ATLANTIC PIONEER	PANAMANTIAN	23	52.4 N	165.9 W	06	29	M 42	2 NM	03	1003.9	4.0	3.0	3	21				
JAPAN RAINBOW	JAPANESE	23	44.0 N	155.0 E	08	28	M 45	5 NM	16	1003.8	- 6.5	2.0	4	8				
MORIL MERIDIAN	AMERICAN	23	39.3 N	145.1 W	06	10	M 48	1 NM	09	990.3	2.2	3	3	10	8	10		
SONGKHLA	DANISH	25	38.3 N	182.1 E	12	30	M 45	5 NM	27	1013.0	7.0		10	6.5	32	13	26	
ZENLIN GLORY	LIBRIAN	26	41.3 N	175.2 W	00	23	M 41	2 NM	18	999.3	11.0	16.0	5	11.5	21	9	26.9	
VAN ENTERPRISE	LIBRIAN	26	41.0 N	170.0 E	12	28	M 46	1 NM	72	999.0	4.0	6.0						
VAN FORT	LIBRIAN	27	39.0 N	170.1 E	12	24	M 30	5 NM	30	999.0	16.0	18.0						
SEALAND COMMERCE	AMERICAN	27	35.0 N	153.2 E	06	34	M 80	5 NM	82	998.0	10.0	14.0	12	32.5	34	13	41	
PACDUCNESS	LIBRIAN	27	39.1 N	158.4 E	00	32	M 48	5 NM	21	997.0	18.0	17.0	6	10				
PRES VAN BUREN	AMERICAN	27	31.3 N	172.9 E	18	27	M 45	10 NM	01	1002.0	16.7	16.7	4	16.5	25	8	29.5	
SEPTA	LIBRIAN	28	32.8 N	158.3 E	12	29	M 45	2 NM	03	1004.0	17.9	18.0	6	10	27	8	14.5	
VAN ENTERPRISE	LIBRIAN	28	39.6 N	158.3 E	12	29	M 47	2 NM	03	997.0	2.0	7.0						
VAN CONQUEROR	LIBRIAN	28	49.1 N	173.5 W	12	15	M 43	2 NM	26	994.0	7.0	3.0						
VAN FORT	LIBRIAN	28	33.0 N	166.8 E	12	27	M 30	5 NM	02	1002.0	17.0	17.0						
ANCO DUKE	BRITISH	28	33.0 N	176.8 E	00	24	M 45	10 NM	02	1001.8	14.4	15.6	9	26	23	11	29.5	
ATLANTIC HIGHWAY	LIBRIAN	28	34.2 N	145.0 E	00	01	M 42	5 NM	02	1020.0	17.0	16.0	5	8	36	6	8	
PRES JEFFERSON	AMERICAN	28	34.8 N	151.7 E	06	35	M 45	5 NM	86	999.0	- 1.1	0.0	7	32.5	33	7	41	
PRES VAN BUREN	AMERICAN	28	31.1 N	171.9 E	00	32	M 28	10 NM	01	1008.5	18.3	16.7	5	10	32	9	32.5	
VAN ENTERPRISE	LIBRIAN	29	39.3 N	156.6 E	00	30	M 30	5 NM	28	1007.5	2.0	8.0	5	14.5	28	7	32.5	
VAN FORT	LIBRIAN	29	39.3 N	156.6 E	00	30	M 30	5 NM	28	1007.5	2.0	8.0	5	14.5	28	7	32.5	
ALUTYAN DEVELOPER	AMERICAN	29	52.6 N	173.8 W	00	12	M 45	10 NM	23	1008.0	13.0	17.0						
PRES VAN BUREN	AMERICAN	29	30.0 N	143.3 E	00	28	M 40	10 NM	01	1013.8	16.7	16.3	5	10	28	13	32.5	
ROOLETTO	SWEDISH	29	31.3 N	160.1 E	06	32	M 45	5 NM	02	1014.0	16.0	20.0	8	10	32	11	26	
TONCI TOPIC	LIBRIAN	30	40.3 N	134.2 E	18	32	M 45	5 NM	08	1018.0	18.0	15.0	8	13				
SEPTA	LIBRIAN	30	38.2 N	144.9 E	18	02	M 43	1 NM	41	1006.3	10.0	13.0	7	10	32	7	14.5	
VIOLET	LIBRIAN	30	40.6 N	178.1 E	00	22	M 45	9 NM	03	998.0	10.0	13.0	12	16.5	23	13	24.5	
ANCO JUNEAU	AMERICAN	30	40.6 N	143.3 E	00	34	M 45	10 NM	05	1014.0	9.0	8.1	2	6.5	32	8	14.5	
SEATRAN PRINCETON	GERMAN	30	32.7 N	162.9 E	00	13	M 44	2 NM	03	1012.3	11.1	18.3	5	6.5	14	8	14.5	
WIRI HARU	JAPANESE	31	40.2 N	170.7 W	12	22	M 30	1 NM	65	992.3	7.5	10.0	3	5	22	8	13	
SEPTA	LIBRIAN	31	40.3 N	161.1 E	00	12	M 42	3 NM	02	1018.3	3.2	7.0	5	5	09	7	10	
PUERTO VALLARTA	MEXICAN	31	22.3 N	108.7 W	14	34	M 55	25 NM	03	1027.0	17.0	26.0	8	6.5				
ENVIRONMENTAL BUOYS																		
46002	AMERICAN	14	42.5 N	130.0 W	06	22	M 46			985.1	10.0	12.6	0	10				
46004	AMERICAN	20	51.0 N	136.0 W	03	03	M 46			998.4	2.5	7.5	8	14.5				
46004	AMERICAN	23	51.0 N	136.0 W	06	26	M 42			1001.6	6.3	7.6	0	10				
46005	AMERICAN	14	46.0 N	131.0 W	12	06	M 46			988.7	7.5	10.1	0	10				
46005	AMERICAN	24	46.0 N	131.0 W	15	32	M 41			1014.2	7.6	9.6	0	10				
46005	AMERICAN	30	46.0 N	131.0 W	02	33	M 47			1005.3	5.4	9.4						
NORTH PACIFIC OCEAN																		
FEB.																		
PACIFIC WING	PANAMANTIAN	1	33.6 N	147.2 E	12	18	M 43	2 NM	33	1008.0	19.0	18.3	7	19.5				
ATLANTIC PIONEER	PANAMANTIAN	1	39.4 N	146.5 E	06	16	M 42	2 NM	81	997.5	13.8	15.0	5	10	18	7	6.5	
HEADWIND	AMERICAN	1	10.4 N	88.8 W	18	03	M 45	25 NM	82	1011.5	25.6	27.2	3	10	18	7	6.5	
VIOLET	LIBRIAN	1	46.3 N	145.1 W	00	14	M 48	25 NM	33	1002.0	8.0	8.0			17	6	8	
PRESIDENT MADISON	AMERICAN	2	34.0 N	178.0 W	06	01	M 43	5 NM	26	1002.0	1.7	2.8	14	26				
CHEVRON WASHINGTON	AMERICAN	2	36.2 N	144.6 W	18	27	M 43	10 NM	01	1011.3	3.4		2	5	27	6	10	
PRESIDENT MADISON	AMERICAN	2	36.3 N	146.1 E	18	27	M 43	10 NM	01	1001.8	3.4		2	5	27	6	10	
SPRUCE	JAPANESE	3	46.0 N	170.3 E	18	30	M 43	2 NM	01	1019.0	3.0	4.5	10	11.5			11.5	
ASIA MINESTY	LIBRIAN	3	48.3 N	156.9 E	06	23	M 43	1 NM	87	1005.0	- 2.0	0.5	19.5	26	6	29.5		
PRESIDENT MADISON	AMERICAN	4	50.2 N	165.0 E	00	27	M 30	5 NM	02	1009.3	1.1	1.7	6	6.5	37	12	29.5	
GREAT LAND	AMERICAN	4	53.6 N	135.6 W	18	19	M 30	5 NM	43	989.0	8.4	7.8		6.5	24	9	11.5	
ROBERTS BANK	LIBRIAN	5	30.6 N	151.8 E	12	35	M 44	8 NM	02	1015.0	14.8	10.0	4	11.5	22	13	19.5	
HONSHU GLORIA	LIBRIAN	5	34.8 N	139.3 W	00	25	M 41	5 NM	50	1021.6	12.5	12.0	4	11.5	22	13	19.5	
GREAT LAND	AMERICAN	5	34.0 N	137.2 E	00	29	M 45	5 NM	82	988.1	2.2	7.8		8	13	24	9	11.5
SURVEYOR	AMERICAN	5	53.4 N	133.9 W	00	25	M 48	2 NM	10	991.0	7.0	6.0		8	13			
NGEN CONGO	LIBRIAN	6	34.1 N	149.2 E	12	16	M 30	5 NM	02	1018.0	17.0	18.0	6	10				
PACIFIC WING	PANAMANTIAN	6	34.3 N	141.5 E	00	18	M 33	5 NM	83	1005.0	16.4	10.0	9	23				
ASIA MINESTY	LIBRIAN	6	36.9 N	141.5 E	00	05	M 43	2 NM	21	1009.0	12.0	12.0						
PUERTO VALLARTA	MEXICAN	7	21.8 N	108.0 W	12	36	M 43	10 NM	00	1025.0	17.5	21.0	6	14.5	34	8	23	
PORTLAND	AMERICAN	7	37.3 N	150.6 W	06	34	M 43	5 NM	70	1002.4	- 9.1	4	6	16.5				
SINCLAIR TEXAS	AMERICAN	10	35.8 N	141.9 W	18	05	M 45	5 NM	13	1004.4	- 2.2	4.5	4	13	05	8	16.5	
GREAT LAND	AMERICAN	11	32.2 N	132.2 W	12	06	M 30	5 NM	88	1005.0	4.2	7.8		18	8	6.5		
PRES POLK	AMERICAN	12	38.9 N	137.3 W	18	32	M 45	5 NM	80	994.0	3.0	12.7	4	8	32	8	23	
NVERSEAS WASHINGTON	AMERICAN	12	44.5 N	128.2 W	22	14	M 47	1 NM	10	982.0	11.7	7.8	7	24.5	14	9	32.5	
ARCO HERITAGE	AMERICAN	12	42.0 N	127.0 W	18	18	M 43	1 NM	07	999.8	11.2	10.0	9	24.5				
TRANSCHAMPLAIN	AMERICAN	12	36.9 N	143.0 W	06	01	M 43	5 NM	02	997.0	8.9	12.2	5	26				
SEALAND FINANCE	AMERICAN	12	37.4 N	139.7 W	06	02	M 48	2 NM	05	992.5	11.1	13.3	5	11.5	02	11	24.5	
ARCO SAG RIVER	AMERICAN	13	46.1 N	128.7 W	06	22	M 42	5 NM	51	969.9	10.0	8.9	3	6.5	19	6	6.5	
PRINCE SAN FRANCISCO	AMERICAN	13	47.5 N	132.3 W	18	30	M 35	10 NM	26	1006.4	7.2	7.2	5	23	33	12	32.5	
SANSHIN II	AMERICAN	13	43.7 N	128.2 W	00	20	M 35	2 NM	52	977.0	10.0	6.3		3	5			
TRANSCHAMPLAIN	AMERICAN	13	36.8 N	137.8 W	00	32	M 40	10 NM	03	1005.1	8.9	10.7	3	13	01	8	36	
SEALAND FINANCE	AMERICAN	13	41.5 N	123.0 W	00	17	M 45	5 NM	43	1000.0	9.4	8.8	8	10	19	11	13	
NVERSEAS WASHINGTON	AMERICAN	13	43.0 N	128.3 W	00	18	M 55	1 NM	10	970.2	12.4	8.9	7	29.5	14	9	49	
MORIL ARCTIC	AMERICAN	14	38.6 N	143.7 W	18	10	M 38	2 NM	14	1000.2	- 5.0	10.2	3	8				
MORIL ARCTIC	AMERICAN	15	34.8 N	138.0 W	18	09	M 35	1 NM	14	998.1	4.5	4.0		10	8	23		
GREAT LAND	AMERICAN	15	33.8 N	135.7 W	18	14	M 30	5 NM	02	td								



Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves <sup>+</sup>		Small Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
<b><u>NORTH PACIFIC OCEAN</u></b>																	
PORTLAND	AMERICAN	19	50.7 N	129.7 W	00	20	42	10 NM	02	1001.2	5.5	6.7	5	13	18	8	16.5
SEALAND MC LEAN	AMERICAN	19	41.4 N	167.3 E	00	24	45	5 NM	10	990.0	8.9	3.9	2	6.5	24	6	24.5
CALIFORNIAN	AMERICAN	20	39.9 N	136.4 W	18	30	50	5 NM	02	1007.9	11.1	13.9	7	8	28	11	24.5
SEA PAN	SINGAPORE	20	59.4 N	179.5 E	03	32	H 44	200 YD	45	998.2	3.9	3.9	6	14.5			
UNIVERSE KURE	LIBYRIAN	20	41.3 N	139.3 W	18	31	H 44	5 NM	99	1010.4	9.2	11.7	8	13			
CALIFORNIAN	AMERICAN	21	39.6 N	136.6 W	00	30	45	5 NM	00	1011.0	11.1	13.9	8	23			
UNIVERSE KURE	LIBYRIAN	21	40.7 N	137.5 W	00	31	H 44	5 NM	80	1011.5	9.0	12.4	5	8	31	9	14.5
SEA PAN	SINGAPORE	22	49.6 N	159.7 E	03	18	H 47	< 50 YD	72	998.4	3.2	2.8	7	18			
MORGENTHAU	AMERICAN	22	54.5 N	165.4 W	18	12	H 49	2 NM	10	1008.0	9.9	9.9	10	13			
MORGENTHAU	AMERICAN	23	54.3 N	164.9 W	00	09	H 41	2 NM	69	1009.9	3.3	4.4	8	11.5			
HONGKONG PHOENIX	SINGAPORE	24	39.4 N	151.9 W	06	31	H 46	200 YD	84	1004.0	10.0		12	32.3	13	>13	29.5
NEWARK	AMERICAN	24	51.3 N	131.5 W	22	16	45	5 NM	07	987.0	10.0	6.0	3	10	16	6	19.5
PRESIDENT MADISON	AMERICAN	24	37.2 N	149.7 E	06	10	45	2 NM	69	997.0	13.9	15.6	10	23			
ASIAN ASSURANCE	LIBYRIAN	24	52.3 N	168.6 E	18	27	H 44	5 NM	03	982.5	3.0	2.0	8	10	27	10	16.5
PUERTO VALLARTA	MEXICAN	25	21.9 N	108.0 W	13	31	H 48	> 25 NM	00	1025.0	19.3	23.0	5	5	31	7	6.5
PHS FILLMORE	AMERICAN	25	33.3 N	149.6 E	06	25	45	5 NM	02	987.5	13.6	18.9	5	8	25	7	19.5
PHS EISENHOWER	AMERICAN	25	33.9 N	149.6 E	06	27	48	5 NM	01	991.0	14.4	17.8	16	24.5			
PACIFIC VENTURE	PANAMANIAN	25	35.6 N	149.1 E	06	31	H 45	2 NM	03	996.5	13.0	19.0	14	24.5			
JAPAN CABO	LIBYRIAN	25	33.5 N	149.6 E	06	27	41	2 NM	16	991.0	16.0	18.0					
ASIAN ASSURANCE	LIBYRIAN	25	51.8 N	167.5 E	00	31	H 46	5 NM	07	992.5	3.0	3.0	8	10	31	8	16.5
ARCO ANCHORAGE	AMERICAN	25	59.1 N	144.5 W	18	14	H 43	5 NM	28	997.5	0.4	2.3	5	10			
PACIFIC VENTURE	PANAMANIAN	26	36.6 N	150.8 E	00	36	H 45	2 NM	02	1000.3	10.0	18.0	14	24.5			
MOBIL ARCTIC	AMERICAN	26	50.0 N	134.3 W	18	20	H 48	2 NM	43	995.7	9.0	4.0			20	7	14.5
GARDENIA	LIBYRIAN	26	54.2 N	166.4 W	06	29	M 30	5 NM	01	987.0	0.0	3.0	10	26	29	9	32.5
ARCO ANCHORAGE	AMERICAN	26	55.6 N	159.0 W	12	14	H 33	5 NM	71	1001.7	1.2	2.7	6	11.5			
SEA PAN	SINGAPORE	27	36.6 N	153.3 E	09	29	H 47	1 NM	21	1000.4	8.6	5.3	6	23			
MOBIL MERIDIAN	AMERICAN	27	52.9 N	153.4 W	06	25	M 40	5 NM	66	988.5	4.3	6.1	5	11.5	25	9	18
<b><u>ENVIRONMENTAL BUOYS</u></b>																	
46002	AMERICAN	12	42.5 N	130.0 W	21	18	M 50			980.1	11.9	11.5	9	21			
46002	AMERICAN	13	42.5 N	130.0 W	00	20	M 55			979.8	10.4	11.6	11	31			
46004	AMERICAN	4	51.0 N	136.0 W	21	25	M 46			1002.3	7.3	7.3	8	19.5			
46005	AMERICAN	13	46.0 N	133.0 W	05	33	M 48			975.4	5.0	9.0					
46006	AMERICAN	12	41.0 N	138.0 W	15	35	M 49			987.0	5.7	12.1	8	18			
46006	AMERICAN	20	41.0 N	138.0 W	18	30	M 41			1007.0	9.1	11.3	8	18			
46006	AMERICAN	25	41.0 N	138.0 W	06	29	M 41			996.2	8.8	11.3	11	23			

+ Direction for sea waves same as wind direction  
X Direction or period of waves indeterminate  
M Measured wind

NOTE: The observations are selected from those with winds  $\geq 35$  kn or waves  $\geq 25$  ft from May through August ( $\geq 51$  kn or  $\geq 35$  ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

## January and February 1979

This listing includes only those ships recruited in the U.S. Cooperative Ship Program whose Ship's Weather Observations (NOAA Form 72-1) were mailed to the National Climatic Center and/or the coded weather observations were transmitted to the appropriate radio station.

[illegible]

## JANUARY AND FEBRUARY 1979

SUMMARY: GRAND TOTAL VIA RADIO 21991    GRAND TOTAL VIA MAIL 47933

# Rough Log, North Atlantic Weather

April and May 1979

**R**OUGH LOG, APRIL 1979--Many of the storms out of North America curved northward over Canada or into Baffin Bay. One storm made the trek from Cape Hatteras to the Norwegian Sea. Several storms formed over the water and dissipated while headed northward. In general the storm paths were shifted westward from their climatic tracks.

This month's mean sea-level pressure differed significantly from the long-term normal. The normal indicates the Icelandic Low off Kap Farvel at 1008 mb. The Azores High is 1021 mb south of the Azores near 30°N, 32°W. There is high pressure over the Arctic with the main center off the Queen Elizabeth Islands.

This month the mean sea-level pressure had three low-pressure centers: a 1015 mb over the Bay of Fundy; a 1012 mb near 42°N, 45°W; and a 1010 mb over the North Sea. The Azores High at 1024 mb was centered north of the Azores near 42°N, 20°W. A part of the Azores High split off to become the Bermuda High at 1021 mb near 28°N, 60°W. The primary center of the Arctic High was 1030 mb over the northern coast of Greenland.

The anomaly analysis showed a minus 5-mb center near 36°N, 40°W, with a minus 3-mb center off the Netherlands. The positive centers were the largest this month. A large positive area with two 12-mb centers covered the Arctic Ocean off the U.S.S.R. There was another 12-mb center between Greenland and Iceland and a plus 8-mb center along the northern coast of Labrador.

The upper air normal at 700 mb has a LOW over Kane Basin with a trough through the Labrador Sea that parallels longitude 60°W. There is slight ridging along longitude 25°W. This leads to a trough along 20°E. This month the LOW was over Bathurst Island. There were two troughs out of this LOW, one along longitude 100°W and the other along 70°W. There was also an incipient LOW over Newfoundland with a trough stretching to the southeast. The ridge along longitude 25°W was accentuated leading into a LOW near the Faeroe Islands with that trough stretching southeastward.

The major anomaly centers were positive over Kap Farvel and negative near 35°N, 42°W, and over central Europe.

**Extratropical Cyclones**--This storm formed on a front associated with a LOW traveling toward Kap Farvel on the 3d. There already was weak cyclonic circulation in the area from another weak LOW close by that was moving eastward. On the 4th the LOW was 996 mb at 36°N, 40°W. It was aligned with an upper air cutoff LOW (fig. 35). The KRPA was near 30°N, 50°W, with 20-ft waves. There were a few isolated gale reports on the 5th and 6th by such ships as the SEA-LAND ECONOMY and USNS COLUMBIA.

The storm system was drifting slowly eastward. The SAXONIA was sailing northeastward and sending 6-hr reports. On the 7th she had 40- to 50-kn winds and waves as high as 33 ft. On the 8th the storm was 998 mb centered over the Azores. On the 9th the OL-

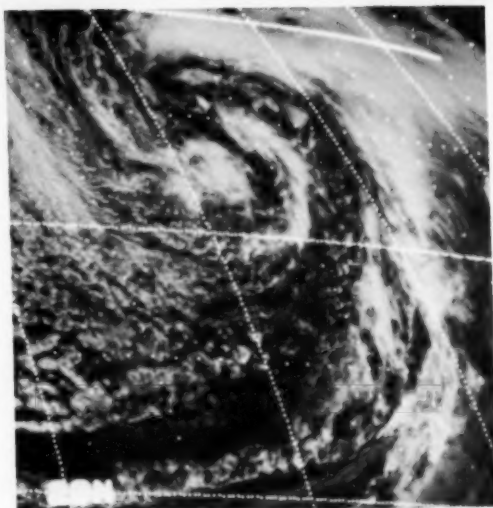


Figure 35.--At 1600 on the 4th this extratropical storm resembles a tropical storm, except there is no central cloud shield.

KUSZ and S. FRANCOIS were both near 39°N, 10°W, with 52- and 50-kn wind reports. The latter reported 20-ft swell waves. A ship northwest of the center radioed swell waves of about 26 ft. On the 10th OWS Romeo measured 20-ft swell waves. The winds were generally 20 to 30 kn, but a ship near 40°N, 20°W, reported 40 kn. On the 11th the LOW was maintaining its central pressure, but losing its circulation as it traveled northward to completely dissipate on the 13th.



**Monster of the Month**--This story begins on the 4th. High pressure was moving across the Great Lakes. A small LOW was near the juncture of the Ohio and Mississippi Rivers. Another was over northern Hudson Bay and yet another near Lake Winnipeg. On the 5th the LOWs from the Ohio River Valley and Lake Winni-



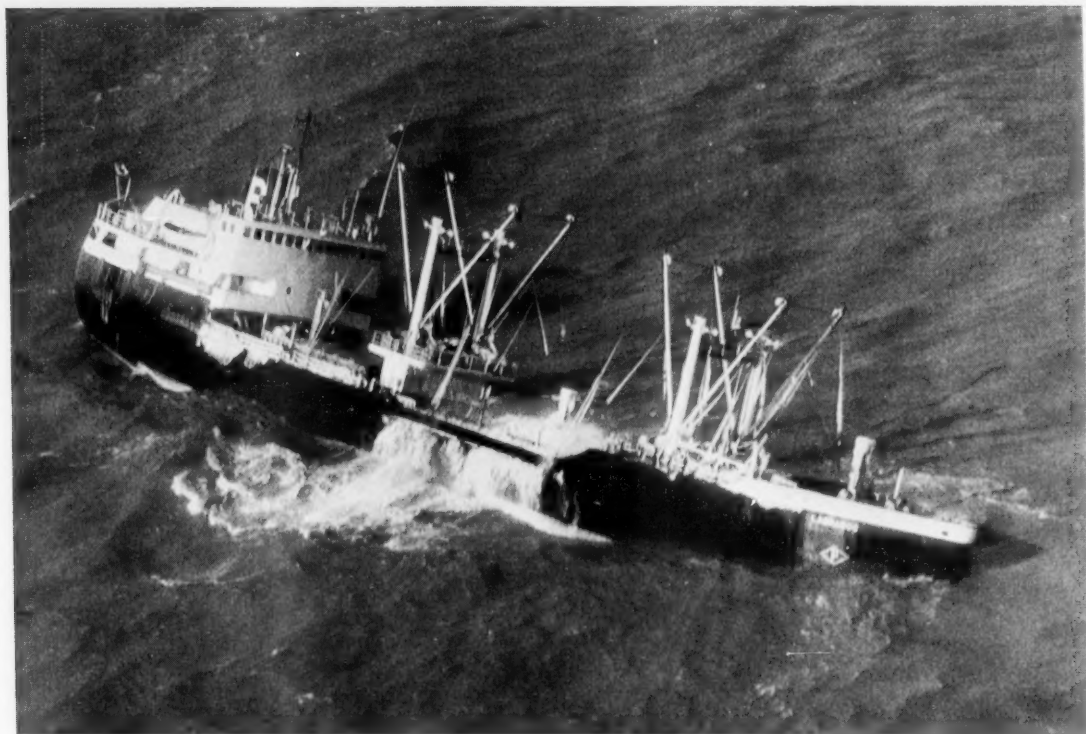


Figure 36.--Waves are breaking over the Canadian ore freighter LABRADOC on the 6th as she founders in Lake Erie near Ashtabula, Ohio. Wide World Photo.

peg were moving northeastward and developing in the usual manner. On the 0000 chart of the 6th both of these LOWs had disappeared, and a new, more intense one was found over Sault Ste. Marie at 994 mb. This storm intensified and moved across the top of the Great Lakes Basin.

The night of the 5th Meigs airport in Chicago, Ill., had gusts to 60 kn. Winds up to 50 kn were blowing from Michigan to New York on the 6th, and there was snow of as much as 1 in per hr in some places. Pellston, Mich., had a gust to 82 mi/h. The Mackinaw Bridge was closed. A seiche was set up on Lake Erie, and ice packs were blown ashore crashing into lake-front homes. Buffalo, N. Y., had gusts to 40 kn on the 5th and 43 kn on the 6th. Detroit had 49-kn gusts on the 5th, and Sault Ste. Marie had 41-kn gusts on the 6th. The 325-ft Canadian ore carrier LABRADOC was lashed by 50-kn winds and 15-ft waves and began taking on water on Lake Erie about 18 mi northwest of Ashtabula, Ohio. The cargo of corn shifted, and the ship listed heavily to port. Fifteen crewmembers were initially rescued by helicopter; 4 hr later the Captain and three others left the ship as it started breaking up (fig. 36). The ship was taken in tow on the 7th and grounded on Pelee Island on the 8th.

At 1200 on the 6th the 985-mb storm was due north of Buffalo, N. Y., and it was bringing strong winds to the East Coast (fig. 37). Wallops Island, Va., measured 40-kn gusts and Blue Hill Observatory in Maine

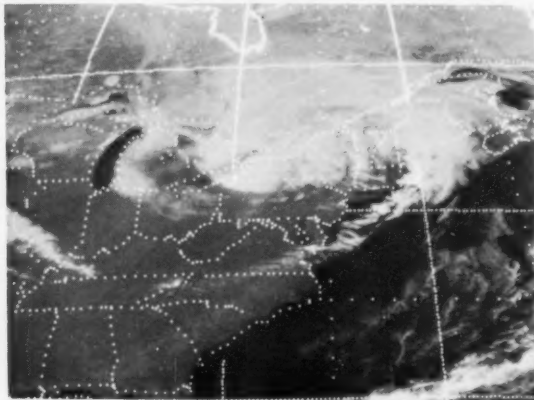


Figure 37.--The storm has moved northeast of Buffalo at 1700. The front stretches along the coast. Note how clear it is over Lake Michigan but cloudy over the eastern shore from moisture that the air picked up over the lake.

had 41 kn. On the 7th Newark Bay was closed to large ships. The replica of the 19th century schooner PRIDE OF BALTIMORE was blown 200 mi off course to Delaware Bay from its intended destination of Nor-

folk. Ships off the coast were reporting 40-kn gales. By the 9th the LOW was north of the Gulf of St. Lawrence and of no consequence. It turned northwestward and ended over Hudson Bay.

This storm came off the eastern slopes of the Canadian Rocky Mountains. On the 9th the LOW was still west of the Appalachian Mountains, but late in the day shipping off the East Coast was feeling its influence. At 1800 the GREEN HARBOR was west of the front with 70-kn northwesterly winds, while the DELAWARE SUN was east of the front with 50-kn southwesterly winds and 23-ft waves.

On the 10th the OPALIA (34°N, 75°W) reported 61-kn westerly winds with 23-ft waves. The storm was moving eastward south of Long Island but immediately turned northeastward to parallel the coast. This was in response to a high-pressure ridge that extended southward from a 1050-mb center over Greenland. On the 11th the tighter gradient was between the front and the ridge. Three ships reported winds over 40 kn in the vicinity of 45°N, 60°W. Late in the day the center magically vanished as another center developed to the south.

This LOW formed in a trough southwest of another LOW that was moving northeastward. At 0000 on the 14th this storm was near 38°N, 49°W. The other LOW had moved to 46°N, 38°W. The primary circulation surrounded both centers. Ships in the northeasterly flow reported 20- to 30-ft swells. The WILD GREBE (43°N, 51°W) had only northerly 40-kn winds, but her swell waves were northeasterly at 36 ft. The KOSMONAUT GAGARIN had northwesterly 58-kn winds and 21-ft seas.

By 0000 on the 15th the LOW was 968 mb near 50°N, 36°W. OWS Charlie had 47-kn winds at 1200. By 0000 on the 16th the northeasterly LOW, which had turned to the north-northwest, became the storm center at 968 mb. The ship UNLM was near the center with 971-mb pressure, 50-kn winds, and 23-ft seas. The LOW drifted northwestward into the Labrador Sea and weakened rapidly as the next storm moved into the area on the 17th.

A complicated frontal system was approaching the Appalachian Mountains on the 14th with the warm front hanging to the south and turning sharply eastward over North Carolina. The warm front lay over Cape Hatteras with a squall line extending into northern Florida. By 1200 a frontal wave had formed off Hatteras (fig. 38). By 0000 on the 16th the storm was 980 mb near 40°N, 59°W. The EASTERN NEPTUNE (39°N, 60°W) measured 983 mb with 60-kn southwesterly winds. Six hours later the ARCTIC TROLL was near the same location (39°N, 59°W) also with 60-kn winds and 33-ft swell waves. Her pressure was 990 mb. The CARCHESTER was following the storm with 25-ft waves. On the 17th the RUDBY had 55-kn winds and 41-ft swell waves south of the center.

The storm was tracking toward the northeast and weakening on the 18th. It moved over Iceland on the 19th with 16-ft waves for OWS Lima. It continued into the Barents Sea on the 22d.

This LOW formed in the wake of the last storm south of Newfoundland on the 17th. At 1200 on the 18th, the

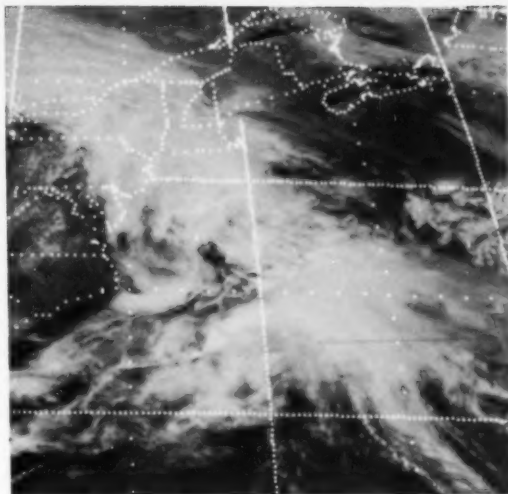


Figure 38.--By 1700 the frontal wave has moved east of Cape Hatteras and is organizing a cyclonic circulation.

LOW was 1000 mb near 40°N, 57°W. The AMERICAN ARCHER was about 90 mi away with 20-ft swells. Six hours later the SLEIDRECHT was near the center with 60-kn southwesterly winds and 26-ft waves. At 0000 on the 19th the storm was 980 mb but less than 600 mi in diameter. A ship close to the center had 45-kn winds. This storm resembled a tropical cyclone in its size and strong winds near the center. After passing over Cape Race it rapidly dissipated on the 20th.

The last third of the month was relatively quiet. There were several LOWs that traversed the shipping lanes from off the east coast of the United States to near Iceland. A large HIGH in the 1030-mb plus range off of France blocked eastward passage of these LOWs.

One last storm of the month beat the blocking High by forming over Denmark Strait and moving across the top. On the 28th the LOW was making a counterclockwise loop over the Norwegian Sea. An English ship, the GTOT was south of the Faeroe Islands with 44-kn winds. On the 29th the same ship still had the strong gales and now reported 20-ft waves. On Jan Mayen Islands winds were measuring 40 kn (fig. 39).

At 1200 on the 29th the 976-mb storm was near 68°N, 10°E, and moving southward. At 1800 vessels over the northern North Sea were reporting winds in the upper 40-kn range. The RIGG reported 52-kn winds and 20-ft seas. At 0000 on the 30th the Faeroe Islands measured 50 kn. As the LOW moved southward over Scandinavia, it brought waves up to 20 ft off the coast.

On the 30th there was a raft of reports over 40 kn as if ships were rushing to meet their monthly quota. In general wind reports were consistently between 40 and 50 kn over the North Sea. There were several reports of 33-ft waves over the northern part. At 0300 a report from the PLAT indicated 60-kn northwesterly winds and 26-ft seas.

Late on the 30th the storm turned northward again and stalled near 69°N, 05°E, on May 2. On the 1st the

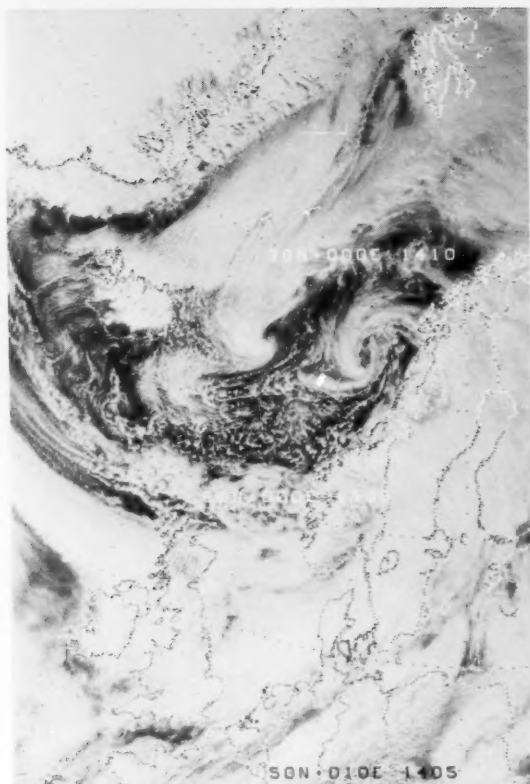


Figure 39.--The storm is off the northwestern Norwegian coast. Note how bright Jan Mayen Island appears. Also, there is an interesting jagged cloud streak, which might be a contrail, southwest of Spitsbergen.

DRUPA had only 38-kn winds near 61°N, 01°W, but had 33-ft swells. The SERENIA nearby at 61°N, 02°E, had 46-kn winds and 30-ft waves. As the storm stalled, it gradually lost its power; and the gale-force winds crept northward until they were no longer supported. The storm stayed in nearly the same position until the 9th.

**Casualties**--The Greek vessel SAPHO (17,867 tons) arrived Honolulu April 1 after heavy weather aggravated former frame damage. The 1,236-ton Venezuelan KATYA sank in rough seas 80 mi from Aruba on the 6th. All were rescued. The 3,672-ton Panamanian IMPALA arrived Bilbao on the 12th with position lights broken by heavy weather.

The British bulkcarrier RAVENSWOOD contacted heavy ice on the 13th 45 mi west of Port aux Basques with slight damage. The British JACK WHARTON (1,597 tons) arrived England on the 17th with apparent heavy-weather damage to cargo. The 9,043-ton Greek STROFADES was icebound at Sault Ste. Marie anchorage on the 11th and had ice damage on voyage into the Lakes.

Helicopters and fishing boats rescued 44 persons

from the burning 6,000-ton Polish freighter REIMUND off Bornholm Island on the 16th. Strong winds and heavy seas were occurring at the time. The 60,789-ton Liberian tanker SEATIGER (fig. 40) was struck by lightning in Port Arthur, Tex., after unloading 230,000 barrels of oil on the 19th. Three people were killed and 30 injured. The vessel exploded and burned.

The 6,366-ton Liberian MOUNT DIRFYS arrived in Norfolk on the 21st with a cargo of combat tanks that were damaged when the tanks shifted in heavy weather.

The 30,560-ton JAGUAR struck a small iceberg in Belle Isle Strait on the 26th. The 28,695-ton Liberian tanker GINO and the 18,673-ton Norwegian TEAM CASTOR collided in fog off the Brittany coast on the 28th. The GINO sank but the TEAM CASTOR made port. All crewmen on the GINO were rescued by the Soviet ship VELIKY OKTIABR. The 23,207-ton Canadian IRVING ARCTIC encountered ice off Newfoundland.

**ROUGH LOG, MAY 1979**--There were no clear-cut paths of LOWs this month. Each storm seemed to wander alone, and many wandered as if they had no clear-cut destination. The closest to what might be called a favored path was from the northern Plains States toward the Labrador Sea and from south of Kap Farvel toward the North Sea.

The mean pressure pattern looked more like its climatic normal counterpart, except it was more intense. A 1007-mb LOW was off Norway near 68°N, 10°E. The Azores High was 1025 mb only a few miles from its 1022-mb partner. There were two small low-pressure centers over northern Quebec and Labrador. A 1012-mb center southeast of Kap Farvel on the climatic normal was missing from the monthly mean.

The most prominent departure from normal was a minus 8-mb center west of central Norway. There was a large positive anomaly with a plus 4-mb center off Spain, a plus 6-mb center east of Kap Farvel, and a plus 4-mb center off the East Coast and over Labrador.

The upper air at 700 mb had a long-wave trough over the eastern United States with a short-wave trough east of Newfoundland. There was also a long-wave trough stretching south over England. The upper air anomalies closely paralleled those at the surface.

**Extratropical Cyclones**--This was a rather mild month. There were few storms, and none of them were especially severe. It was more like a summer month than a spring one.

An inverted trough was moving across the northern tier of states, and a LOW formed near Chicago on the 3d. The LOW almost lost its identity on the 4th and 5th as another LOW formed to the north and moved northward. The system deepened over Newfoundland on the 6th as more maritime air was fed into the circulation. The island of St. Pierre on the south coast measured 40 kn. At 1200 a ship with the call sign VOPL reported 52-kn westerlies near the Gaspé Peninsula. At 1800 the FORT CALGARY was south of Cape Race with 25-ft waves. On the 7th and 8th the storm was stationary slightly east of St. John's. Several ships had winds in the gale category and two had winds in the 50-kn range. The highest waves were 20 ft.

At 1200 on the 9th the LOW was 995 mb near 44°N,



Figure 40.-- The deck and side of the SEATIGER are split open from the violent force of the explosion which was set off by a lightning strike. Wide World Photo.

45°W (fig. 41). The SEA-LAND VENTURE was 250 mi to the south with 33-ft swell waves. On the 11th the LOW was drawn into a counterclockwise loop by passage to the north of another LOW. There were a few gales observed. On the 12th this LOW absorbed the interloper. The BREEHELLE (50°N, 27°W) had 58-kn southwesterly winds east of the occlusion. The

LAURENTIAN FOREST found 26-ft swells south of the center as did several other ships in the area. On the 13th the OLAU WEST near 60°N, 35°W, was buffeted by 55-kn northerly winds and 30-ft seas. At 1200 the 984-mb storm was near 61°N, 25°W. Lima measured 40-kn winds, which became 45 kn on the 14th with 20-ft seas. By the 16th the storm had disappeared over northern Norway.



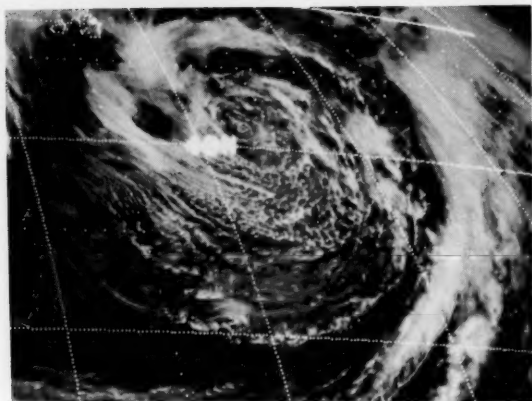


Figure 41.--At 1800 the high-level circulation center is near 42°N, 47°W. The front has moved far to the east of the storm and is almost separated from it.

As the LOW described above moved south of Iceland there was a weak col area over the Labrador Sea, and the LOW occupied it on the 14th. The storm moved due east along latitude 56°N (fig. 42). The storm was almost centered on Lima on the 16th at 0000. At 0600 her winds were 39 kn. Later at 1800 the GXOB near 50°N, 18°W, had 55-kn winds and 26-ft seas. As the storm moved north of Ireland on the 17th Romeo had



Figure 42.--At 1622 on the 15th the storm is still west of OWS Lima. An area of unstable turbulent weather is indicated by the bright comma-shaped cloud about to pass her location.

20-ft seas. The LOW disappeared over the North Sea on the 18th. At the same time a LOW popped up near Cape Finisterre and the TAUPO had 45-kn northerly winds. Far to the south the ELAT also found 45-kn winds. On the 19th the LOW moved over Spain and then northward over England.

This LOW formed south of the Denmark Strait at 54°N. There already was cyclonic circulation to the south. The Azores High had been firmly entrenched near 35°N, 40°W, for over a week. The LOW was 994 mb near 51°N, 26°W, at 0000 on the 27th. The LEONID LEONIDOV 250 mi to the southwest had 18-ft waves with 35-kn winds. At 1800 the STREAMBANK near 48°N, 25°W, had 44-kn westerly winds. The storm was north of OWS Romeo on the 28th and treated her to waves up to 20 ft although the winds were only 25 kn. On the 29th the storm disappeared north of Ireland.

This storm formed on the 29th in a spot favored for such things--near Kap Farvel. The Azores High had a double center, but the eastern one dissipated on the 31st as the LOW moved southeastward and the HIGH became the Bermuda High. By 1200 the LOW was 990 mb near 52°N, 27°W. Two ships in the southwest quadrant had 35-kn gales, and the NOVA SCOTIA east of the front had 20-ft swell waves from the south. The H1070 was near 47°N, 40°W, or about 600 mi south-

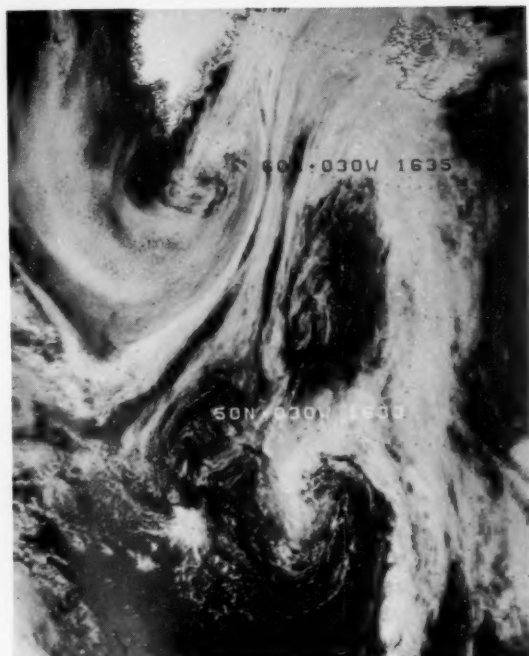


Figure 43.--There are only scattered clouds associated with most of the storm, except in the southerly flow which extends to Iceland. Another LOW has just formed southeast of Kap Farvel.

west of the storm with 45-kn winds and 25-ft seas.

At 1200 on June 1 the storm was 992 mb near 46°N, 29°W. Romeo had 40-kn winds and 20-ft seas. The ATLANTIC CINDERELLA near 47°N, 39°W, found 45-kn winds. On the 2d Romeo and the ACHILLES nearby had 40-kn winds and 25- and 28-ft waves (fig. 43). On the east side of the storm near latitude 50°N several ships had gales and waves to 25 ft. A British ship in the same area had 52-kn winds and 23-ft waves. The LOW was now traveling northward. On the 3d at 1200 it was 996 mb near 55°N, 27°W. The ALBRIGHT

PIONEER found 23-ft waves 350 mi to the south. On the 4th the storm was gone.

**Casualties**--The 9,057-ton Great Lakes carrier ASHLAND ran into the North Entry Pier at Duluth on the 9th, when thick ice prevented the vessel from making a turn in time. During a storm on the 10th the 180-ton American supply vessel DELTA SEAHORSE hit the drilling platform RANGER 1 in the Gulf of Mexico and the jack-up platform collapsed. One person was known dead and seven were missing on the 11th.

## Rough Log, North Pacific Weather

### April and May 1979

**ROUGH LOG, APRIL 1979**--The majority of this month's storms traveled over the western part of the ocean into the Bering Sea. Two storms during the second week of the month made it from the western ocean into the Gulf of Alaska. A group of storms wandered over the ocean north of Hawaii. Several storms developed on the east and northeast side of the Pacific High and affected the North American coast.

The major differences from climatology were that the storm tracks were shifted westward and a primary track from south of Fox Islands in the Aleutians into the Gulf of Alaska was missing.

There were major differences between this month's mean sea-level pressures and pattern and the climatological normals. Climatology indicates four low centers of 1009 and 1010 mb from the Kenai Peninsula to north Sakhalin Island. The Pacific High at 1023 mb is elongated along latitude 33°N. High pressure over the Polar region is 1021 mb maximum.

This month the mean showed one 1000-mb LOW at 55°N, 175°E. The Pacific High was elongated as usual with a central pressure of 1025 mb near 40°N, 153°W. The maximum pressure over the Polar region was 1030 mb.

These differences resulted in significant anomalies. Two had the most affect on ships. One was a minus 10 mb with the Aleutian Low near 55°N, 175°W. This negative area covered the corner of the North Pacific west of Alaska's west coast and north of latitude 40°N. The other was a plus 9-mb center over the Gulf of Alaska near 57°N, 147°W. There was a plus 12-mb center over the Polar region. There is no doubt that this affected the global weather, but not over the North Pacific directly.

The upper air circulation at 700 mb was also significantly different. There was a closed LOW over the Bering Sea instead of the normal trough. The normal ridging over the North American coast was sharper and west of the coast. This produced anomalies corresponding to those at the surface.

Typhoon Cecil occurred this month.

**Extratropical Cyclones**--This is a transition month from the large, deep winter storms to generally weaker summer storms. The majority of the deeper storm systems tracked into the Bering Sea as indicated by the mean pressure pattern. In general, the Pacific High was well established and farther north than usual

blocking storms entrance into the Gulf of Alaska.

The first significant storm of the month moved over the East China Sea on the 1st. It tracked east-northeastward south of Japan and was 994 mb near 45°N, 178°E, by 0000 of the 5th. It was generating only minimal gales. At this time it turned sharply north-eastward, and at 0600 the CRESSIDA found 60-kn westerly winds as the storm started deepening. The seas were 26 ft. At 0000 on the 6th the storm was over the Aleutians at 960 mb (fig. 44). The SHIN SHIEN (47°N, 168°W) had 58-kn winds, but only reported 13-ft seas. A Japanese ship was north of Dutch Harbor with 78-kn winds. The JAPAN VENTURE south of the center by 350 mi reported 53 kn.



Figure 44.--There is little doubt about where this storm is centered as the clouds spiral into it. The western edge of the front is very sharp and distinct.

The storm was tracking up the island chain. On the 7th a SHIP near 43°N, 141°W, had 60-kn winds on her starboard beam slightly east of the warm front. Other ships including the PRESIDENT MADISON were reporting 40-kn winds with waves as high as 20 ft. At latitude 55°N the storm turned eastward while weakening and disappeared from the analysis by the 10th.

This storm was a frontal wave that extended from the previous LOW on the 6th. By 1200 on the 7th this was a small tightly wound storm at 984 mb near 39°N, 172°E. Several ships reported 50-kn winds, including the MUREX with 23-ft waves. A ship with the call letters of JKMG was traveling with the storm with 45- to 50-kn winds and waves of about 20 ft. On the 9th the storm was moving northeastward. The HOHB was near 44°N, 169°W, with 47-kn winds, 36-ft seas, and 26-ft swells. As the storm moved south of the Alaska Peninsula and over the top of the 1034-mb Pacific High, it dissipated rapidly (fig. 45).



Figure 45.--The storm is weakening, but it has left a large heavy arc of clouds over the top of the persistent Pacific High.

This was an example of a case of explosive development which often catches forecasters flat-footed, especially in data-sparse areas. The 1200 chart of the 11th showed the 1030-mb Pacific High at 35°N, 137°W. There was a 1039-mb HIGH centered over the north coast of Alaska. A weak front wrapped around the top of the Pacific High with a col area off the Alaska Peninsula. The upper air chart had a weak LOW over Vancouver Island associated with a weak surface LOW over the state of Washington. A small surface LOW was indicated on the 1800 chart of the 11th.

By 1200 on the 12th the LOW was 984 mb off Vancouver Island (fig. 46). The upper air LOW had suddenly deepened. At 1800 ships along the Washington-Oregon coast were finding 40- to 50-kn winds. The ALASKA STANDARD (52°N, 130°W) had 50-kn winds. At 0000 on the 13th buoy 46005 measured 45-kn winds and 26-ft waves. Six hours later that buoy and 46002

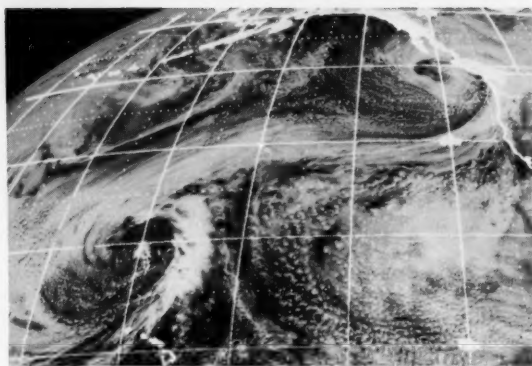


Figure 46.--A cloudless area indicates the center of this storm. The edge of the front is so sharp that it appears to have been drawn in. The continuity of weather is clearly indicated here.

both measured 21-ft waves. By 1200 on the 13th the LOW had moved inland, and a few hours later it was no longer significant.

A LOW was over the Sea of Japan on the 16th. As it crossed Japan, double centers developed and the second center persisted. At 0000 on the 17th the FRIENDSHIP was east of the second center with 45-kn southeasterly winds at the warm front. The VAN ENTERPRISE was between the two centers near 40°N, 147°E, with 58-kn westerly winds. Neither reported waves. By 0000 of the 18th the LOW had consolidated into a 974-mb center near 46°N, 156°E. The PAPHYRUS MARU was about 180 mi south of the center at 0600 with 50-kn winds and 26-ft swells. At 2100 the YAMASHIN MARU was about 600 mi southwest of the storm's center with 58-kn northwesterly winds and 28-ft waves.

The storm moved northward on the 19th and 20th. On the 20th the GARDENIA had 40-kn winds, 36-ft seas, and 20-ft swells as she sailed westward through the front near 52°N, 170°W. At 1200 Ostrov Beringa measured 45-kn winds. On the 21st the LOW moved over eastern Siberia.

A LOW from the East China Sea moved eastward south of Japan on the 19th and 20th. Late on the 20th this LOW developed at the occlusion east of the other LOW and within 12 hr was the only center. At 1200 on the 21st the TOYOTA MARU No. 1 had 40-kn gales on her stern. On the 22d the ADRIAN MAERSK, about 100 mi south of the 979-mb center, had 45-kn winds and 20-ft swells. The LOW was 967 mb near 52°N, 175°E, at 0000 of the 23d (fig. 47). The FREISENSTEIN was near the center with 971 mb and 23-ft swell waves. The PRESIDENT WILSON and PACBARON were in the vicinity of 54°N, 170°W, with 55-kn winds and waves to 23 ft. In the southwest quadrant the JUNEAU MARU (48°N, 169°E) had 44-kn winds from 290° driving 13-ft seas mixed with 33-ft swells from 360°. At 1200 observations were sparse, but St. Paul and Unimak Islands measured 35-kn winds. The Coast Guard cutter STORIS was north of St. Paul Island on the 24th with 40-kn winds and 20-ft seas. The storm moved through the Bering Strait later in the day.

Another storm of Chinese origin. It passed over Hok-

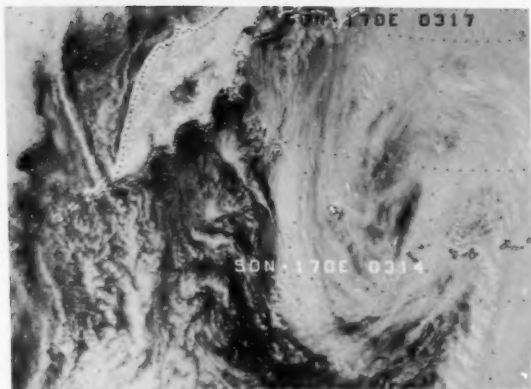


Figure 47.--The storm is centered in the Aleutians bringing their typical cold, cloudy and windy weather. Still, the snow-covered surface shows through.

kaido bringing heavy rain to the islands. It caused little disturbance as it traveled northeastward into the Bering Sea. At 0000 on the 26th the 990-mb storm was near 51°N, 175°E. The GLADIOLUS was northeast of the center near 55°N, 171°W, with 58-kn southerly winds. At 0600 the HOHB had 25-ft waves south of the Fox Islands. St. Paul Island had gusts to 40 kn, and at Cold Bay they exceeded 40 kn.

On the 27th the Coast Guard cutter JARVIS south of Saint George Island had 50-kn winds from the south. The storm was now 968 mb, but it rapidly eroded as it traveled over ice and through the Bering Strait.

More rain for Japan as this storm passed south of the Islands on the 26th. The storm was east of Tokyo on the 27th when two ships north of the warm front had winds over 40 kn and seas to 20 ft. On the 28th a ship with 991-mb pressure had 50-kn winds and 23-ft waves near the center of the 990-mb storm. The LONDON VISCOUNT was traveling with the storm and faithfully radioing weather observations. At 0600 on the 28th she had 50-kn winds about 210 mi south of the center. Waves of 20 to 25 ft were being reported in the southwest quadrant. The LING YUNG was near the warm front (42°N, 176°W) with 45-kn winds from the south-east and 33-ft swells.

It appeared that this storm was going to make it across the Gulf of Alaska, but it was weakening; and this center disappeared on May 2 as another formed.

**Tropical Cyclones--Cecil** was spotted on the 11th east of Palau Island and west of Woleai. He began a trek toward the west-northwest. On the 13th as a tropical storm, Cecil moved across Palau, a former major Japanese naval base. He became the first male typhoon the following day. Maximum winds climbed to 80 kn near Cecil's center before he rammed ashore over Leyte on the 15th. On the 16th Cecil blanketed the Visayas group with strong winds and heavy rains (fig. 48). Cecil was responsible for 29 deaths with at least 100 people missing. Crop damage was estimated at almost \$3.6 million. Cecil weakened and recurved for the next few days. By the 20th he was heading northeastward as a weakening tropical storm, crossing the 130th meridian near 21°N.

**Casualties--**The 7,809-ton Singapore-registered NEPTUNE SAPHIRE bound for Kobe reported heavy-wea-



Figure 48.--Early on the 16th Cecil covers the northern Philippines.

ther damage on the 3d. The 108-ton fishing vessel CITY OF SEATTLE sank 90 mi off Yakutat on the 7th. The crew was saved by the Coast Guard. The weather at the time was 12-ft swells and 40-kn winds. The 13,193-ton Liberian YULSAN POSEIDON was blown by strong winds and grounded in Busan outer harbor on the 24th.

On the 25th there were four collisions involving eight ships in fog. The 999-ton SHINCHO MARU and the 499-ton KAISEI MARU collided near Tokyo Bay. Twelve crewmen were missing. On the Inland Sea the 11,463-ton ferry SUNFLOWER with 984 passengers and 44 crewmen collided with the 1,133-ton container-ship MEIKO MARU with a crew of 13. All persons were safe. The ferry towed the container-ship to shallow waters as it was leaking. The 13,267-ton Liberian freighter VALERIA and the 619-ton LPG carrier No. 5 SHOGI MARU brushed each other, and the 10,381-ton Greek cargo ship FRATERNITY and the 682-ton LPG carrier KAIHO MARU scraped each other.

The 261-ton tug ESSAR towing two barges encountered heavy weather south of Hawaii, and the towline broke.

**ROUGH LOG, MAY 1979--**In contrast to the Atlantic the Pacific storm tracks followed climatology rather closely. The primary path was from south and east of Japan east-northeastward to the Gulf of Alaska. There was a swarm of storms over the Alaska Peninsula which climatology only hints at.

The mean sea-level pressure pattern differed from climatology mainly concerning the Aleutian Low. This month it was a 1002-mb center near Unimak Island versus three 1009-mb LOWs across the Bering Sea with the easterly one matching this month's single LOW. The Pacific High was the largest of all the features as usual. It was 1025 mb near 34°N, 140°W, which was 5° longitude east of its climatic 1023-mb position. There was the usual high pressure over the Arctic Ocean.

The only significant anomaly center was minus 9 mb near 52°N, 163°W. In general the pressure was lower than normal north of latitude 35°N and west of longitude 145°W.

The upper air pattern showed a LOW over the Fox Islands. This was southeast of and 57 m lower than its climatic position over the Bering Sea. The usual trough was over the Japan Sea and along the California coast with a ridge over Alaska and British Columbia.



Tropical storm Dot formed in the western North Pacific and hurricane Andres in the eastern ocean.

**Extratropical Cyclones**--This month's storms were relatively weak, and there did not appear to be as many as would be expected. On the 3d there was a LOW moving northward into the Gulf of Alaska, and another LOW formed to the south of it. A SHIP near 41°N, 169°W, had 45-kn winds as this new LOW tightened the pressure gradient. By 0000 on the 4th several ships were finding gales in the same relative position to the storm. Another SHIP at 35°N, 151°W, near the front claimed 68-kn winds and 16-ft waves. The LOW was 990 mb on the 5th near 47°N, 138°W, and the SANKOSTAR had 40-kn gales. On the 6th the storm stalled near Vancouver Island and dissipated on the 7th.

This LOW was born on a stationary front between two large high-pressure cells of the Pacific High. On the 6th there were northeasterly winds on the northwestern side of the front and southwesterly winds on the south-eastern side. This set up a cyclonic circulation, and an upper air short-wave trough triggered a frontal wave on the 7th. The western HIGH was pushing eastward, and the LOW raced northeastward around the eastern HIGH. On the 9th two ships had 40-kn winds near 39°N, 158°W, near the front. The PORTLAND (55°N, 144°W) and the SINCERE No. 3 (51°N, 136°W) both had 45-kn winds from the east and southeast, respectively (fig. 49).

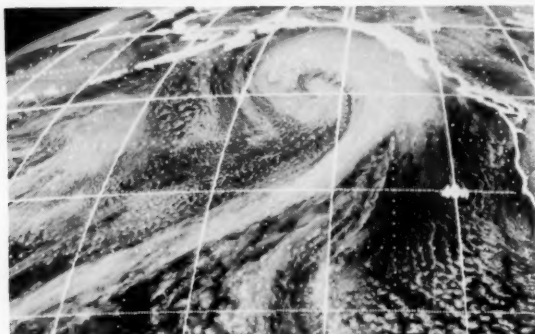


Figure 49.--This is how the storm appeared at noon on the 9th local time.

At 0000 on the 10th the LOW was 976 mb near 53°N, 145°W. OWS Papa had 50-kn westerly winds. The CGC SWEETBRIER was tossed by 26-ft waves, while the EXXON SAN FRANCISCO and PRINCE WILLIAM SOUND both had 45-kn winds near 54°N, 138°W. At 1200 the PORTLAND had a thunderstorm and 20-ft waves.

In 12 hr the pressure rose 23 mb as the storm moved over the Alaska coast.

A trough was swinging southeastward over the Japan Sea on the 11th and by 1200 it was over Tokyo with a small LOW center. By 1200 on the 12th it was 986 mb near 41°N, 154°E. A ship about 450 mi to the southwest had 45-kn gales. On the 13th at the 0000 observation, 10 ships reported around the storm with 35- to 45-kn winds (fig. 50). The LEON PIERRE had 25-ft waves. At 0600 she had 55-kn winds and 20-ft waves.



Figure 50.--This storm does not appear as bad as the ships described it, but there are indications of instability.

The GOLDEN GATE BRIDGE also found 55-kn winds near 38°N, 161°E, while a ship near 35°N, 155°E, had 33-ft swell waves.

At 0000 on the 14th this was a fairly large storm with an 800-mi radius at 986 mb. It was centered at 44°N, 173°E. A SHIP north of the center had 55-kn northeasterly winds. In the southwest quadrant a ship found 23-ft waves. A second LOW developed on the 16th and this one dissipated.

This storm was exported from Shanghai on the 13th. By the time it was over Japan on the 14th it was a well-formed storm and brought gales to ships near and among the islands. The VAN ENTERPRISE was near the center with 72-kn southeasterly winds, 20-ft seas, and 39-ft swells at 0000 on the 15th. By 0600 the winds had decreased to 62 kn, but the swell waves were up to 49 ft. Two other ships in the same area reported 30-ft swell waves. For some undetermined reason, the storm suddenly filled and disappeared.

**Monster of the Month**--As the last storm suddenly disappeared this one formed near Hokkaido. It spread its area of influence, and by 0000 on the 18th it was 984 mb near 48°N, 152°E. There were a few reports of gale-force winds. By 0000 on the 19th the storm was 960 mb (fig. 51). The SANHO MARU (50°N, 179°E) was in 46-kn winds with 21-ft seas. The SUGAR TRADER was less than 50 mi away with 54 kn and 23-ft waves. A few hours later the GENISTRA (49°N, 166°E) had 51-kn winds and 31-ft waves, while the MORI MARU (49°N, 171°E) had only 36-kn winds with 30-ft swells. Cold Bay, Alaska, measured gusts up to 42 kn.

On the 20th the 968-mb LOW was near 55°N, 178°W.

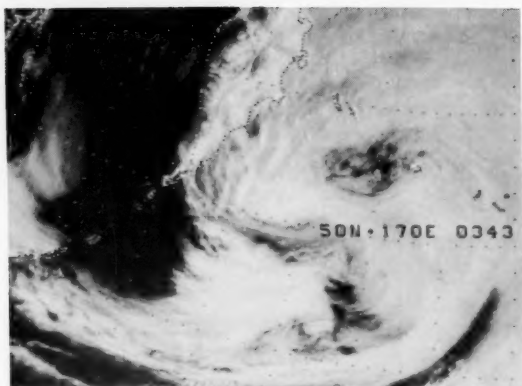


Figure 51.--These bright clouds indicate they are cold and high. The darker shades of white north of the center are at lower levels.

The MIEKAWA MARU was southwest of the Near Islands with 45-kn winds and waves to 23 ft. Other ships were reporting gales and waves up to 26 ft. On the 21st a Korean ship not far from OWS Papa reported 48-kn winds. On the 22d the storm was weakening and on the 23d and 25th made an odd jump to the north before dissipating on the 26th.

Two Japanese ships can take credit for initially providing the observations that indicated the formation of this frontal wave on the 23d. Both had heavy rain with

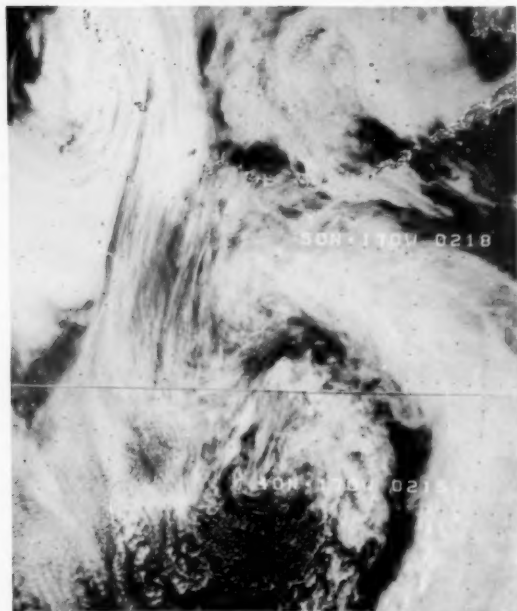


Figure 52.--The storm of interest is near 40°N, 170°W. Another LOW is off Kamchatka, and the interaction of the circulations makes an interesting pattern.

light winds, one from the east and the other from the south. The wave developed rapidly and was 994 mb near 42°N, 168°E, at 1200 on the 24th. A ship east of the center near the occlusion had 40-kn southerly winds. On the 25th the GOLDEN GATE BRIDGE had 47-kn winds and 15-ft waves. A ship in the southeast quadrant had 21-ft waves.

The AMERICAN RELIANCE (41°N, 174°E) and the EXPORT COURIER (41°N, 168°E) both had 40-kn winds southwest of the center, with the latter reporting 33-ft waves. On the 27th there were still gales and high waves near the same relative position to the LOW (fig. 52). The CARNATION found 33-ft swell waves and others 20 to 25 ft. The storm turned northward on the 27th and died on the 29th.

**Tropical Cyclones, Western Pacific**--Dot developed west of Palau Island on the 10th. She moved west-northwestward across Mindanao and into the South China Sea before really developing. Late on the 13th after recurving back toward the Philippines, Dot reached tropical storm strength. This lasted for a few hours as she approached Manila. Once over Luzon Dot weakened rapidly. She hung on for a few more days, finally dissipating in the Philippine Sea on the 16th.

**Tropical Cyclones, Eastern Pacific**--Hurricane Andres began life in the waning hours of May some 300 mi south of the Gulf of Tehuantepec. Meandering aimlessly at first, Andres finally got his act together and headed north. On June 2 he reached tropical-storm strength (fig. 53). The following day Andres became a hurricane as he began turning northwestward to parallel the Mexican coastline about 50 mi south of Acapulco. By the 4th winds near his center were up to 80 kn with gusts to 90 kn. However, about midway between Acapulco and Manzanillo, Andres turned and rammed ashore, where he weakened rapidly.

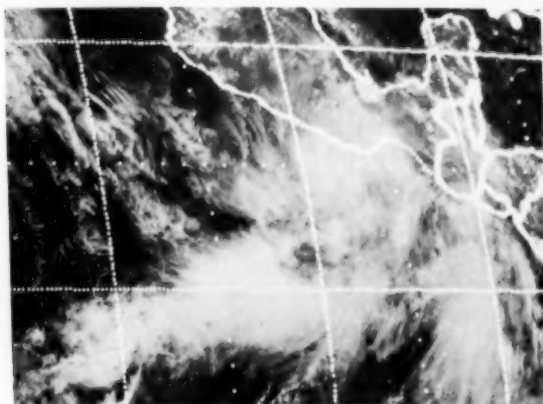


Figure 53.--Andres is a tropical storm at this time late on the 2d and not very well organized.

**Casualties**--The British ACT 3 (23,818 tons) from St. John, N.B., to Wellington, New Zealand, reported heavy-weather damage on the 19th. The 19,907-ton British ISLAND PRINCESS was surveyed at Vancouver for heavy-weather damage incurred on the 27th.

# Marine Weather Diary

## NORTH ATLANTIC, AUGUST

**WEATHER.** The favorable weather that is characteristic of summer continues into August, the warmest month of the year over the North Atlantic. The monthly pressure analysis shows the 1022-mb subtropical High centered near 35°N, 43°W, while the Icelandic Low, a broad, flat, east-west trough, reaches its lowest pressure (1008 mb) over Hudson Strait.

**WINDS.** Over the middle latitudes (40° to 60°N), winds from the southwest through the northwest occur with the greatest frequency. North of latitude 60°N, they become northerly between Greenland and Iceland, and variable south of Iceland and over the southern Norwegian Sea. The prevailing winds over the North Sea are from the westerly quarter of the compass. Between 40° and 25°N, the prevailing direction is from the north and northeast over the extreme eastern Atlantic, and from the south and southwest over the western ocean. Northwesterlies—known by many names, including mistral, etasians, and maestro—blow over the Mediterranean Sea. The northeast trades of the Atlantic lie principally between 25° and 15°N, extending to the South American coast over the Caribbean Sea. Near the approaches to the United States at these latitudes, the trades become more easterly—the Gulf of Mexico has prevailing easterly winds. Southeasterlies are dominant near the Equator, between South America and Africa. Windspeeds on the North Atlantic in August average slightly more than force 3, with lower speeds over the western Mediterranean, the Davis Strait, and the Gulf of Mexico.

**GALES.** Winds of gale force, except in tropical cyclones, are very infrequent south of 52°N. North of this latitude, gale frequencies of about 5 percent are fairly common, with maximum frequencies of 10 percent or more over the Norwegian Sea and the waters south and west of southern Greenland.

**EXTRATROPICAL CYCLONES.** A few moderately strong summer LOWs move about north of 40°N. Storms that attain severe intensities during August are usually of tropical origin. Primary storm tracks for extratropical cyclones are from Hudson Bay to Davis Strait, and from east of the James Bay region and the eastern Grand Banks to just south of Iceland and then eastward through southern Scandinavia. A short primary track lies off the U. S. East Coast. A secondary storm track crosses eastern Lake Superior before joining the primary track over central Quebec.

**TROPICAL CYCLONES.** August is one of the principal months in the North Atlantic hurricane season, ranking second behind September in tropical storm development and also in the number of these storms that attain hurricane force. An average of 2.6 tropical storms occur during August, and 1.6 or 2 out of 3 develop to hurricane intensity. A maximum of seven cyclones occurred in August 1933; and, in contrast, no storms were reported during 1941 and 1961. In general, the level of tropical cyclone activity increases as August advances, with the likelihood of storm occurrence being more than twice as great in the last 10 days as during the first 10 days of the month. The spawning area of tropical cyclones is much larger in August than during the preceding month. Some tropical cyclones originate as disturbances over southwestern portions of the "African Bulge," intensify into tropical depressions southwest of the Cape

Verde Islands, gather strength as they are carried across the lower latitudes of the North Atlantic by the prevailing easterlies, and then enter the Caribbean, Gulf of Mexico, Florida, or the western Atlantic, as fully developed hurricanes. A characteristic of this activity is the split mean storm track around the Bahamas, with one branch passing to the north of the islands, where it recurves off Cape Hatteras, and the other over the southern portion of the island chain.

**SEA HEIGHTS** of 12 ft or more are encountered more than 10 percent of the time over a portion of the northern ocean south of southern Greenland and several hundred miles southwest of Iceland. Two other areas are also observed. One lies west of the British Isles, while the other is hosted by the Denmark Strait.

**VISIBILITY.** In general, fog is both less frequent and less extensive than earlier in the summer. Percentage frequencies of visibilities less than 2 mi occur 10 percent or more of the time north of a line from Cabot Strait southeastward to include the Grand Banks, thence northeastward to near 50°N, 35°W, northward to 65°N, 35°W, then southeastward to Scotland. The line then extends north- and eastward to the northern coast of Norway. A 20-percent oval-shaped area, about 600 mi in diameter, is centered off Newfoundland near 50°N, 50°W. Another 20-percent area is north of Iceland over the southern Greenland Sea.

## NORTH PACIFIC, AUGUST

**WEATHER.** Mild summer weather continues over the North Pacific. Fog decreases, but both tropical and extratropical cyclones are more numerous. Temperatures reach their maximum for the year. By the middle of the month, the 1010-mb Aleutian Low has reappeared over the northern Bering Sea, near 61°N, 178°W. The subtropical High (1025 mb) is centered near 38°N, 152°W, in August.

**WINDS.** The northeast trade winds are the most persistent feature. They prevail south of about 35°N, and to 40°N over the eastern ocean. Over the Philippine and South China Seas, they quickly shift to the southwest monsoon. Off the Asian coast, the winds turn to southerly, and continue to shift to southwesterly over the northern latitudes. Over the western Bering Sea, they are westerly. Over the central ocean north of latitude 40°N, and over the eastern Bering Sea, the prevailing direction is southwesterly. The winds over the Gulf of Alaska are westerly, shifting to northerly along the American coast. Winds of force 3 to 4 generally account for over 50 percent of the speeds.

**GALES,** although unusual in areas not affected by tropical cyclones, do occur more than 5 percent of the time over the heart of the Bering Sea, along the easternmost capes of Kamchatka, and northwest of the Bering Strait. Owing to the influence of tropical cyclones, another small area of greater-than-5-percent frequency is centered near 25°N, 134°E.

**EXTRATROPICAL CYCLONES.** The number of extratropical cyclones is slightly higher in August than in the preceding month. Most of these storms form off the coast of Japan and move northeastward into the Bering Sea. Others enter the Bering Sea after developing off the southeastern tip of Kamchatka; these storms often journey as far north as Kotzebue Sound. Still another primary cyclone track scampers toward



the Gulf of Alaska from a point near 51°N, 158°W.

**TROPICAL CYCLONES.** The frequency of tropical cyclones in the western North Pacific reaches a peak in August and September. About five tropical storms can be expected in August; three or four reach typhoon intensity. Typhoons in August are displaced farther to the north than in July and have less of a tendency to pass directly over the northern Philippines. Some move directly toward Japan and Taiwan; others may pass over Japan after recurving over the Yellow Sea. Those storms that do enter the South China Sea usually move west-northwestward into the Gulf of Tonkin and North Vietnam.

Over tropical waters west of Mexico, four or five tropical storms usually occur—a maximum for any month. The average duration of these storms is 6 days, and about half attain hurricane intensity. As in July, cyclones usually move in a west-northwesterly direction out to sea, where they almost always die after meeting colder waters and more stable air. Occasionally, however, one recurves before it has moved too far from the coast and moves inland over Baja California or the Mexican mainland.

**SEA HEIGHTS.** During August, sea heights of 12 ft or more are rare and occur less than 10 percent of the time across the entire North Pacific Ocean.

**VISIBILITY** improves very slightly during August. An area about 300 mi in diameter, where the visibility is less than 2 mi over 40 percent of the time, is centered just south of the Kamchatka Peninsula. The 30-percent line surrounds this area, reaching into the Sea of Okhotsk and to the Near Islands. The 10-percent line includes the southeastern half of the Sea of Okhotsk to 40°N at 160°E, along 40°N to 170°W, to 53°N, 137°W, to the Kenai Peninsula of Alaska. This area includes all of the Bering Sea.

#### NORTH ATLANTIC, SEPTEMBER

**WEATHER.** With the approach of autumn, subdued weather conditions that characterize the summer season over the higher latitudes gradually give way to increased cyclonic activity resulting from moderate intrusions of colder air. The Icelandic Low deepens to about 1006 mb, and is centered roughly halfway between Iceland and southern Greenland. The Azores High (1021 mb), centered near 33°N, 40°W, is a little weaker than in August.

**WINDS.** Almost without exception, the prevailing winds are westerly between 40° and 60°N. However, over the Grand Banks and the waters east of there to about 40°W, southerly winds prevail, and winds are variable south of Nova Scotia and over the Bay of Biscay. Speeds across this latitudinal belt are generally about force 4. South of 40°N, somewhat lighter winds average about force 3. Wind directions are frequently variable between 30° and 40°N, along the axis of the subtropical High, but northerlies dominate between 20°W and the Strait of Gibraltar. Between 30° and 10°N, easterly winds predominate over the western ocean (northeasterly over the Caribbean Sea), and northeasterly winds are the rule over eastern waters. Northwesterly winds blow over the Mediterranean, and southeasterlies are common over the extreme southern North Atlantic. Northerly winds prevail south of

the Denmark Strait, while southwesterlies predominate over the Norwegian Sea. Northwesterly and southeasterly winds are most common over the southern approaches to the Davis Strait. Windspeeds north of 60°N average force 4 east of Greenland, but near the Davis Strait, more reports of force-2 winds are received than of any other speed group.

**GALES.** The frequency of gales increases in September, particularly over northern latitudes. Frequencies of 10 percent are found just south of Greenland's southern tip, over the open waters between northern Labrador-southern Baffin Island and southwestern Greenland, over the Norwegian Sea, and over the waters north and south of Iceland. The highest frequency, 20 percent, is found over waters well north of Iceland, and over a portion of the Norwegian Sea. Elsewhere, 5-percent frequencies are fairly common north of 50°N. South of 40°N, gales are unlikely to be encountered except in storms of tropical origin.

**EXTRATROPICAL CYCLONES** are more frequent than in August, and occasional severe storms may be encountered. Primary storm tracks lead northeastward from the waters off Labrador and Newfoundland to southern Iceland, and then over the Norwegian Sea. Another major storm track enters the Davis Strait from the Hudson Bay-northern Quebec region, while a third advances up the Baltic Sea from southern Scandinavia into Russia. One secondary storm track crosses the Straits of Mackinac on its way from the Great Plains to the primary track over Labrador. The storm track off the U.S. East Coast has moved seaward and extends from off Cape Hatteras to Sable Island.

**TROPICAL CYCLONES.** Tropical storm activity reaches a peak in September. Climatology indicates that an average of 3.4 tropical storms occur in September, 2 of which develop to hurricane strength. As many as seven tropical storms were reported in September (1949), while in 1930 there were none. The entire western ocean is subject to these storms, many of which originate east of the West Indies and move westward over or north of these islands, either to enter the Gulf of Mexico, or to recurve northeastward over western waters. Some storms entering the Gulf recurve over Florida and often parallel the U.S. East Coast. Another breeding ground for tropical cyclones is over the Caribbean, east of Nicaragua. Many tropical storms or hurricanes are still packing considerable punch when they reach northern shipping routes.

**SEA HEIGHTS** of 12 ft or more have a frequency of 10 percent or higher over most of the North Atlantic between 50° and 65°N, while small areas of 20-percent frequency occur off Greenland's southern tip and over the Denmark Strait.

**VISIBILITY.** Percentage frequencies of visibility less than 2 mi exceed 10 percent north of a line drawn from the western Labrador Sea eastward to 57°N, 48°W, and then southwestward to encompass all of Newfoundland and the Grand Banks. From there, the line extends north-northeastward to the waters south of the Denmark Strait, and then eastward, barely missing the southern tip of Iceland, before dipping southeastward to include the Pentland Firth and the Hebrides. The line then passes east of the Shetland Islands before entering the Norwegian Sea midway between Ice-





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land and Norway. Percentage frequencies of visibility less than 2 mi decrease to less than 10 percent over the central and northern portions of the Davis Strait, but increase to more than 20 percent over the northern reaches of the Labrador Sea above 60°N, and over the waters north of Iceland, east of the Denmark Strait. Over a small portion of the latter area, near 69°N, 16°W, the percentage frequency of visibility less than 2 mi exceeds 30 percent.

#### NORTH PACIFIC, SEPTEMBER

**WEATHER** over the North Pacific continues to be generally pleasant in early September, but, as the month advances, early winter-type storms occur over the northern shipping lanes. Western portions of these routes are also subject to tropical cyclones. A closed Aleutian Low reappears in September, centered over southwest Alaska, with a central pressure of 1007 mb. The 1021-mb subtropical High, near 36°N, 146°W, has weakened considerably and is centered about 300 mi southeast of its August location.

**WINDS.** The prevailing winds over the middle latitudes of 40° to 60°N are from the western quadrant, shifting to more southerly near the Asian coast, and northerly near the American coast. Over the Bering Sea, they are northwesterly, shifting to northerly over the Bering Strait. The northeast trade winds are predominant south of 30°N, shifting to the north along the American coast, and southwesterly winds predominate over the southern Philippine Sea and South China Sea, where the southwest monsoon is firmly established. There are two areas where the winds appear to be out of phase. One is the northern Gulf of Alaska, with prevailing easterlies; and the other is along the coast of southern China and the East China Sea, with northeasterlies. The average speed is force 3 to 4.

**GALES.** Winds of 34 kt or higher are encountered between 5 and 10 percent of the time over much of the open Pacific north of about 45° to 50°N over eastern waters, and between about 37° and 45°N over western waters. A typhoon-influenced area of frequencies greater than 5 percent extends from the East China Sea to the Philippine Sea.

**EXTRATROPICAL CYCLONES.** Well-developed extratropical storms occur more frequently in September than in August. Most of these move northeastward from the Japanese Islands to pass over southwestern Alaska. Others enter the Gulf of Alaska from the waters south of the eastern Aleutians. Storm tracks are displaced southeastward from those of August.

**TROPICAL CYCLONES.** On the average, four or five tropical storms can be expected in the western North Pacific in September, almost as many as in August. About three of these will achieve typhoon strength. These storms usually originate in the lower latitudes west of about 150°E, and initially move west-northwestward. Some travel across the northern Philippines and the South China Sea, while others recurve in the vicinity of the Philippine Sea to pass over or near the Japanese Islands.

About three tropical storms will whirl off the Mexican coast in any given September. One or sometimes two will usually become a hurricane. These storms either originate over the waters off southern Mexico and move northwestward parallel to the coast (and sometimes inland), or develop near the Revillagigedo Islands and move westward out over the open ocean.

**SEA HEIGHTS** of 12 ft or more are common 2 to 10 percent of the time north of about 35°N over eastern waters, and north of about 30°N over western waters (excluding the Bering Sea)--as well as over the South and East China Seas, the Gulf of Tehuantepec, and the lower Gulf of California. Two areas of maximum frequency greater than 10 percent are within an elliptically shaped area between 46° and 50°N, and 162° and 179°E, and over the Okhotsk Basin.

**VISIBILITY.** Fog is less prevalent in September than in August, but it is still frequent north of about 40°N. Frequencies of 10 percent or more of visibility less than 2 mi are common over the waters between 40°N and the Bering Strait, west of 145°W, and east of 150°E. However, the Alaska Peninsula and the Gulf of Alaska, included within the above area, host frequencies of less than 10 percent. A region of frequencies greater than 20 percent surrounds the waters of southern Kamchatka southwestward to the central Kurils, then eastward to Ostrov Beringa.

